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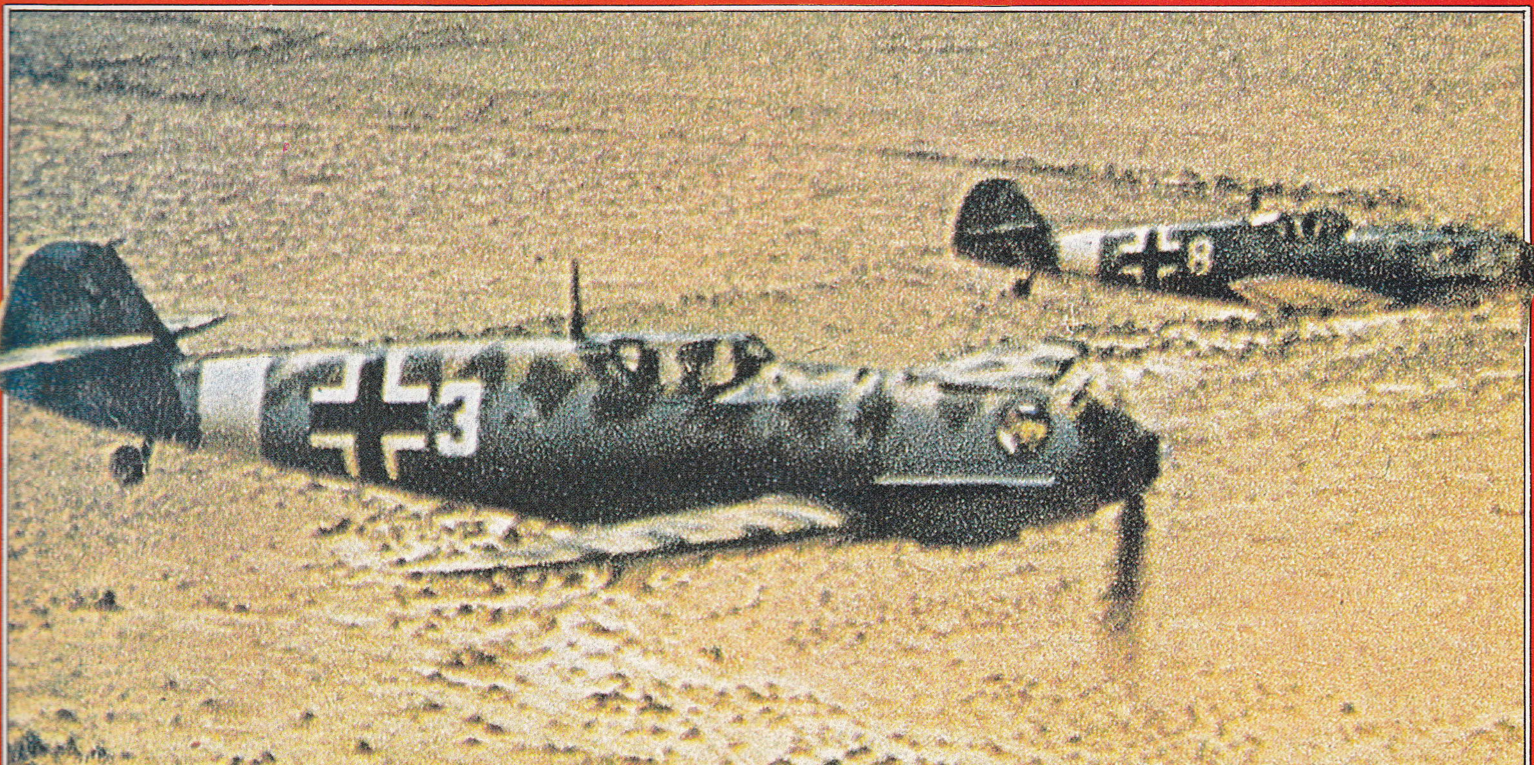

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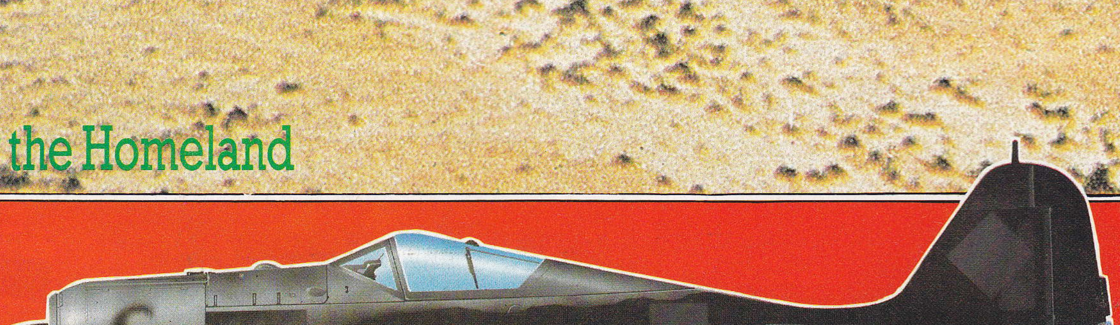

Axis Fighters over the Desert

Messerschmitt Bf 109 in Action

Armed Forces of the World: Soviet Navy (Part 4)

A fully illustrated guide to Axis Fighters of World War II

WAR MACHINE

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Axis Fighters of World War II

The superb fighter aircraft of Germany and Japan achieved substantial air superiority, which greatly assisted the advance of their respective armies. By contrast, the Italians, short of first-class fighters, were rapidly outmatched.

The Nakajima Ki-43 was an exceptionally manoeuvrable fighter, but its armament of only two machine-guns proved inadequate as the war progressed.

The air forces of the three principal Axis partners, trained and equipped as they were for wholly differing concepts of warfare when each entered World War II, possessed fighter aircraft of widely varying qualities and capabilities. Germany, whose Luftwaffe was intended primarily as a support arm of the Wehrmacht (itself intended as an offensive force employing *Blitzkrieg* tactics during a rampage through Europe) possessed what was perhaps the world's finest fighter in 1939, the Messerschmitt Bf 109, albeit somewhat less well-armed than the Supermarine Spitfire. It had, moreover, gained an operational workout during the war in Spain, while the Spitfire was still hamstrung by tactical limitations. However, like the RAF's fighter, the Bf 109 underwent continuous development throughout World War II and remained the cornerstone of the Jagdverband (fighter arm) right up to the end.

Representing an intended Bf 109 replacement, the Focke-Wulf Fw 190 entered service in 1941 and was roughly equivalent in concept to the RAF's Hawker Typhoon. It was infinitely superior in the air combat role, yet was itself to become the *Sturmjäger* (assault fighter) par excellence, being called on to take over from the desperately vulnerable Junkers Ju 87 as the Wehrmacht reeled under the gigantic blows of the Red Army after Stalingrad.

Italy was particularly unfortunate in not possessing during 1940 aircraft engines comparable with the Rolls-Royce Merlin and Daimler-Benz DB 601, and had thus to make do with small air-cooled radials whose development potential was very limited, so that the early Regia Aeronautica fighters, such as the Fiat CR.42 and G.50, were scarcely a match for the Hawker Hurricane and Curtiss P-40 Tomahawk against which they were ranged in Greece and the Western Desert. The Macchi C.202 proved a marked improvement, however, but was itself about two years too late to recover any significant laurels in the Mediterranean.

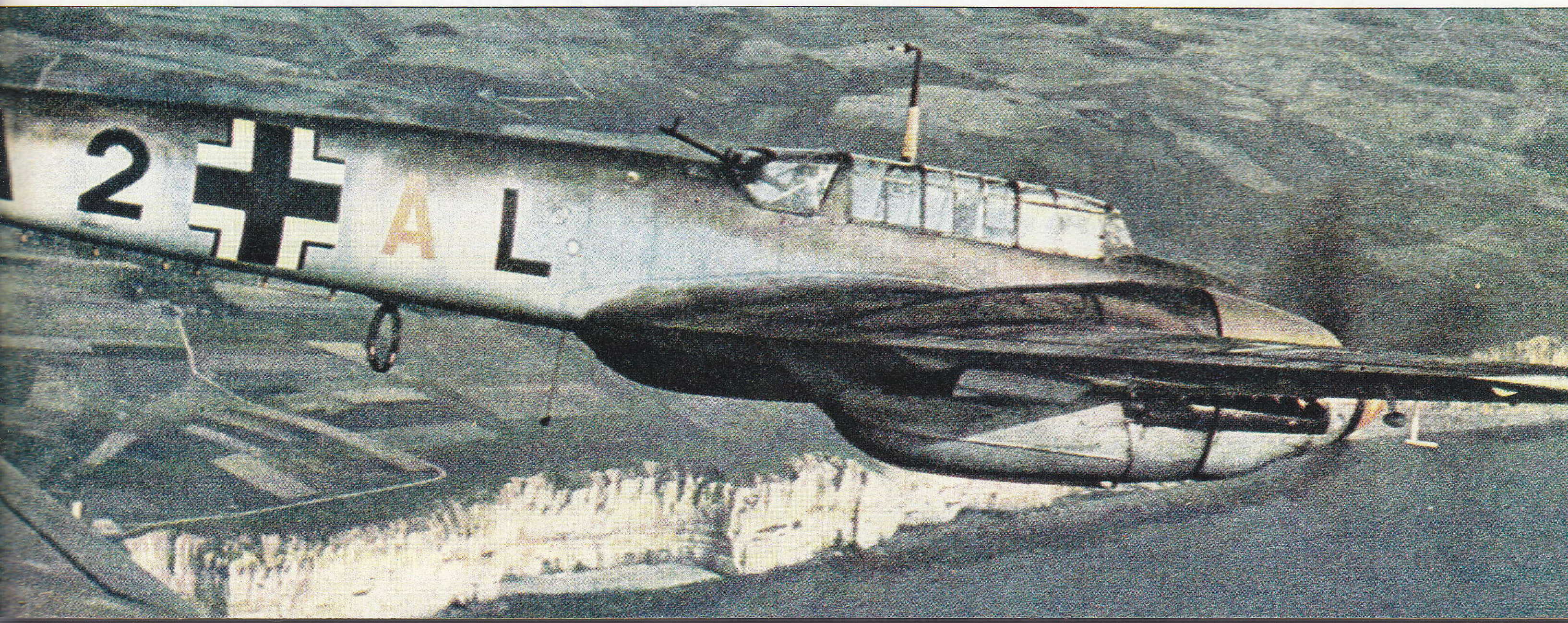
In the Far East, Japan embarked on an intended two-year campaign, the basis of which was seaborne assault across the Pacific. Accordingly priority had been afforded to the development of the carrierborne fighter, of which the famous Mitsubishi A6M Zero was probably the best in the world in 1941. Even in 1943 this excellent aircraft was capable of holding its own against Allied naval aircraft; however, by then the fortunes of Japan were already on the decline and in 1944, as the Americans pushed back the enemy's perimeter and acquired bases from which to raid the Japanese homeland, there was no truly effective metropolitan-based interceptor available with which to combat the heavily armed and escorted Boeing B-29 bombers. Such an eventuality had never entered the Japanese war planners' minds.

Perhaps the most astonishing facet of the fighter's war was the superb quality of the German Jagdverband, having regard to the task for which it was originally intended: patrol in the skies over the battlefield. It was never envisaged that it would be employed for bomber escort (as it was in the Battle of Britain), or that it would be called on to defend the Reich against massed bombers. When misused, it suffered accordingly, not so much due to any failings of the pilots as to their aircraft's lack of range and armament. Only by 'bolting on' special armament was the latter failing partly overcome.

As evidence of the German fighter pilots' extraordinary prowess in their intended role of battlefield cover one has only to compare the astonishing victory scores of their *Experten* (aces): 15 men each gained over 200 combat victories, the majority over the cauldron of the Eastern Front, although the highest-scoring German in North Africa (Hans-Joachim Marseille) shot down 158 RAF and Commonwealth aircraft, all while flying the Bf 109. By contrast the highest-scoring Allied pilot, a Soviet, reached a tally of 62, while the RAF's top score (gained by the South African, Pattle) was 41, a high proportion of them Italian biplanes.

A measure of the excellence of the German fighter pilot is afforded by the all-time highest scorer, Erich Hartmann: his ultimate tally of 352 accredited victories was achieved in three and a half years; of these, 260 were Allied fighters, and all were destroyed while flying the Bf 109. He himself was shot down only twice, and at the end of the war he was aged just 23.

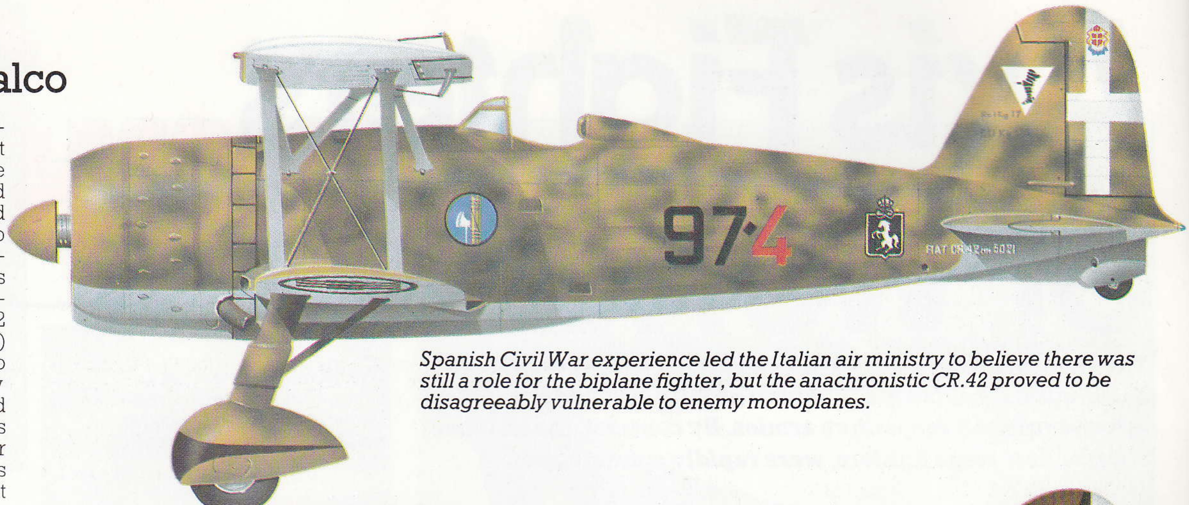
A Messerschmitt Bf 110 is seen over the English Channel in 1940, where the type received a severe mauling from RAF Spitfires and Hurricanes. After this the Bf 110 was assigned to fighter-bomber and reconnaissance roles and later achieved greater success as a night fighter.



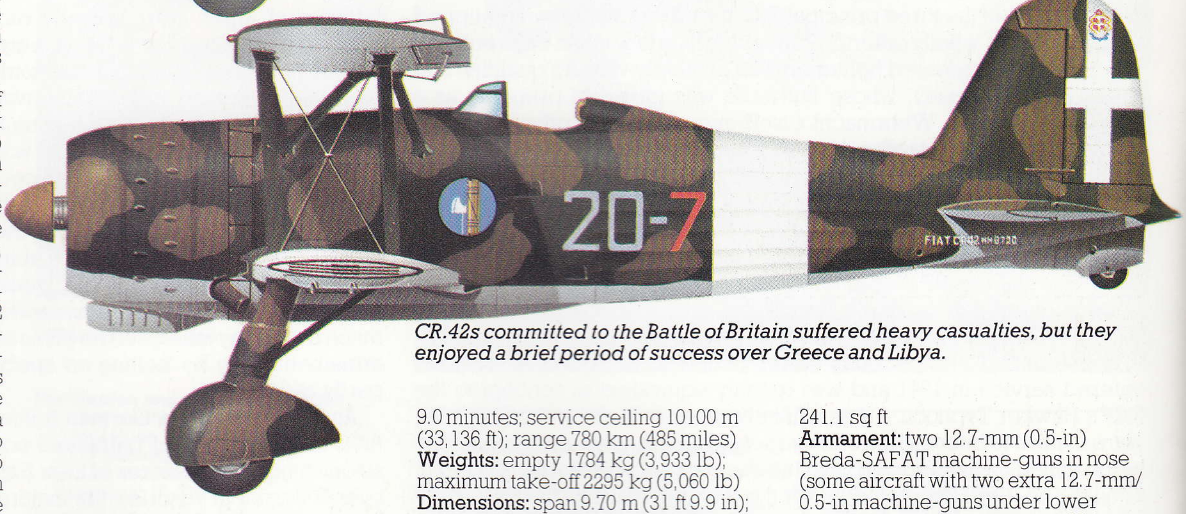
ITALY

Fiat CR.42 Falco

Often compared in concept and design with the Gloster Gladiator, against which it frequently fought in 1940-1, the **Fiat CR.42 Falco** (falcon) biplane did not first fly until 1939, however, and such an anachronism is difficult to understand. Employing the same Warren truss system of interplane struts as the 1933 **CR.32**, from which it was developed, Celestino Rosatelli's CR.42 was powered by a 626-kW (840-hp) Fiat A74 R1C 38 radial and had a top speed of 441 km/h (274 mph). By September 1939 the Falco equipped three *stormi* and, while the RAF was hurriedly reducing its Gladiator strength, the Regia Aeronautica was increasing its CR.42 inventory, so that when Italy entered the war in June 1940 there were 330 in service with four *stormi* in the Mediterranean plus two *squadriglie* in Italian East Africa. The Falco first saw combat in the brief French campaign, and later 50 aircraft accompanied the Corpo Aero Italiano to bases in Belgium for attacks on southern England at the end of the Battle of Britain, suffering heavily to the guns of RAF Hurricanes. In the Middle East the Falco fared better, however, being more of a match for the widely-used Gladiator; during the Greek campaign one *gruppo* of three CR.42 *squadriglie* was committed and, except on a few occasions, acquitted itself well; but when Hawker Hurricanes eventually arrived the Italian biplane losses mounted steadily. In East Africa 51 crated CR.42s were received to supplement the 36 aircraft delivered to the 412^a and 413^a Squadriglie, but in due course they were destroyed in the air or on the ground, although they took a heavy toll of the antiquated aircraft of the RAF and SAAF. In the Western Desert CR.42 fighters were joined by the **CR.42AS** fighter-bomber version adapted to carry two 100-kg (220-lb) bombs, and these continued in service with the 5°, 15° and 50° Stormi Assalti until November 1942. A total of 1,781 CR.42s was built (some serving in Sweden and Hungary), but at the time of the Italian armistice in September 1943 only 64 remained serviceable.



Spanish Civil War experience led the Italian air ministry to believe there was still a role for the biplane fighter, but the anachronistic CR.42 proved to be disagreeably vulnerable to enemy monoplanes.



CR.42s committed to the Battle of Britain suffered heavy casualties, but they enjoyed a brief period of success over Greece and Libya.

Specification
Fiat CR.42 Falco

Type: single-seat fighter
Powerplant: one 626-kW (840-hp) Fiat A74 R1C 38 radial piston engine
Performance: maximum speed 441 km/h (274 mph) at 6000 m (19,685 ft); climb to 6000 m (19,685 ft) in 9.0 minutes; service ceiling 10100 m (33,136 ft); range 780 km (485 miles)
Weights: empty 1784 kg (3,933 lb); maximum take-off 2295 kg (5,060 lb)
Dimensions: span 9.70 m (31 ft 9.9 in); length 8.26 m (27 ft 1.2 in); height 3.05 m (10 ft 0.1 in); wing area 22.40 m^2 241.1 sq ft
Armament: two 12.7-mm (0.5-in) Breda-SAFAT machine-guns in nose (some aircraft with two extra 12.7-mm/0.5-in machine-guns under lower wing), plus provision for two 100-kg (220-lb) bombs

Italy's CR.42s soldiered on through 1942 despite suffering mounting losses. The type was also exported to Belgium, where they were quickly destroyed during the German invasion, and to Hungary, which used them against Yugoslavia and in the 1941 Russian campaign.

ITALY

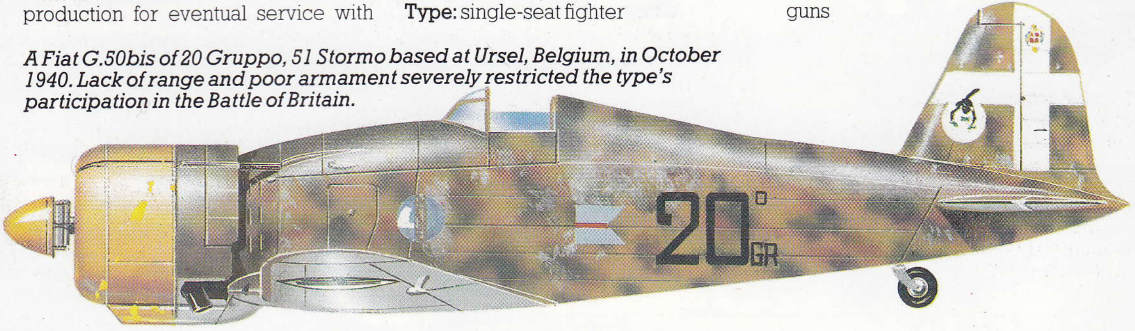
Fiat G.50 Freccia

Representing the first design essay of the young technician Giuseppe Gabrielli with the Fiat company, the **Fiat G.50** fighter was designed in 1935-6 but, although a break from the traditional biplane formula, offered much less in operational potential than the contemporary Hawker Hurricane and Messerschmitt Bf 109. The prototype G.50 first flew on 26 February 1937 and was the first all-metal monoplane with constant-speed propeller and retractable landing gear to be evaluated by the Regia Aeronautica. Named **Freccia** (arrow), the G.50 was ordered into production with the CMASA company (a subsidiary of Fiat) and 12 of the first aircraft were sent to Spain for operational evaluation. Despite the superiority of the Macchi C.200, it was decided to go ahead and equip one *stormo* and one *gruppo* with the G.50, and an initial order for 200 aircraft was placed. In November 1939 the type was delivered to the 51° Stormo, and soon afterwards to the 52° Stormo, and when Italy entered the war in the following June 118 Freccias were in service. In November 1940 48 G.50s of the 51° Stormo moved to Belgium to take part in the air attacks on the UK; however, they saw little action, being principally engaged in 'surveillance' duties. In September that year the prototype of a new version, the **G.50bis**, had flown, and with improved cockpit armour and increased fuel this entered production for eventual service with five *gruppi* in North Africa. With a maximum speed of only 460 km/h (286 mph) and an armament of two machine-guns, the G.50 was hardly a match for RAF fighters in the Mediterranean, yet survived in service until July 1943. Production eventually reached 245 G.50 and 421 G.50bis fighters, and 108 of a dual-control two-seat trainer, the **G.50B**. G.50s were also supplied to the Croatian and Finnish air forces.

Specification
Fiat G.50 Freccia

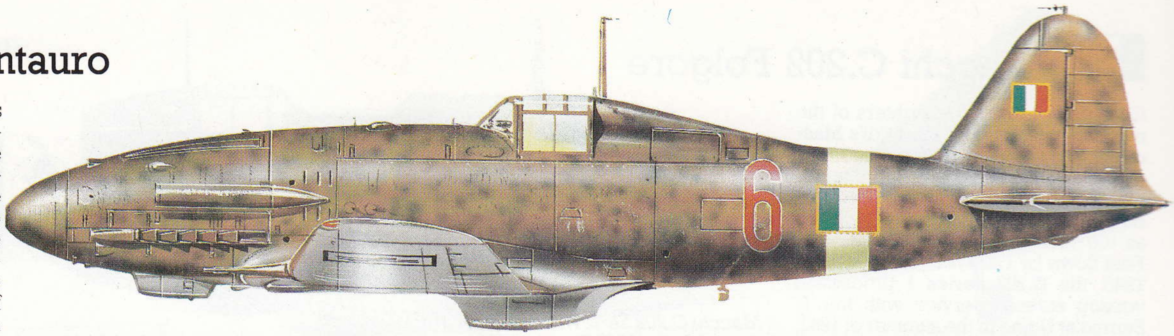
Type: single-seat fighter
Powerplant: one 626-kW (840-hp) Fiat A 74RC 38 radial piston engine
Performance: maximum speed 460 km/h (286 mph) at 4000 m (13,123 ft); climb to 4000 m (13,123 ft) in 4.6 minutes; service ceiling 10750 m (35,269 ft); range 580 km (360 miles)
Weights: empty 1965 kg (4,332 lb); maximum take-off 2400 kg (5,291 lb)
Dimensions: span 11.00 m (36 ft 1.1 in); length 7.80 m (25 ft 7.1 in); height 3.28 m (10 ft 9.1 in); wing area 18.25 m^2 (196.45 sq ft)
Armament: two nose-mounted 12.7-mm (0.5-in) Breda-SAFAT machine-guns

A Fiat G.50bis of 20 Gruppo, 51 Stormo based at Ursel, Belgium, in October 1940. Lack of range and poor armament severely restricted the type's participation in the Battle of Britain.



ITALY

Fiat G.55 Centauro



The main users of the Fiat G.55 were the squadrons of the Fascist Air Arm. This example belonged to Squadriglia 'Montefusco'.

The **Fiat G.55 Centauro** (centaur) was an all-metal low-wing monoplane single-seat fighter designed by Giuseppe Gabrielli, and represented a great improvement by comparison with the previous Fiat monoplane fighter to go into production, the G.50. Great care was taken to blend an aerodynamically advanced airframe with a structure which was robust and would lend itself to mass production. Its configuration included fully-retractable landing gear and a raised cockpit providing an excellent view. Fast and maneouvrable, the type proved popular with its pilots.

The first of three prototypes was flown on 30 April 1942; the third (MM 493) was the only one to carry armament, comprising one engine-mounted cannon and four fuselage-mounted machine-guns. It was evaluated under operational conditions from March 1943, but by then the Italian air ministry had already decided on mass production of the G.55. However, only 16 **G.55/0** pre-production and 15 **G.55/I** initial production aircraft had been delivered to the Regia Aeronautica by September 1943, production thereafter being for the Fascist air arm flying alongside the Luftwaffe. Before wartime production ended 274 more were completed and a further 37 were abandoned at an advanced construction stage.

Before the armistice of September 1943, G.55s had participated in the defence of Rome with the 353ª Squadriglia of the Regia Aeronautica. The post-armistice operations were mainly with the Fascist air arm's Squadriglia 'Montefusco', based at Venezia Reale, then with the three *squadriglie* which formed the 2° Gruppo Caccia Terrestre, but losses were heavy, as a result mainly of Allied attacks on the airfields. While the war was still in progress, Fiat flew two prototypes of the **G.56**, which was developed from the G.55 to accept the more powerful Daimler-Benz DB 603A engine. Built during the spring of 1944, they incorporated minor structural changes and had the fuselage-mounted machine-guns deleted. The first prototype survived the war and was used subsequently by Fiat as a test-bed.

Specification

Fiat G.55/I

Type: single-seat fighter

Powerplant: one 1100-kW (1,475-hp) Fiat RA 1050 RC-58 Tifone (licence-built DB 605A) 12-cylinder inverted-Vee piston engine

Performance: maximum speed 630 km/h (391 mph); climb to 6000 m (19,685 ft) in 7 minutes 12 seconds; service ceiling 12700 m (41,667 ft); range 1200 km (746 miles)

Weights: empty equipped 2630 kg (5,798 lb); maximum take-off 3718 kg (8,197 lb)

Dimensions: span 11.85 m (38 ft 10.5 in); length 9.37 m (30 ft 8.9 in); height 3.13 m (10 ft 3.2 in); wing area 21.11 m^2 (227.23 sq ft)

Armament: one 20-mm Mauser MG 151/20 engine-mounted cannon, two similar wing-mounted cannon, and two fuselage-mounted 12.7-mm (0.5-in) Breda-SAFAT machine-guns, plus provision for two 160-kg (353-lb) bombs on underwing racks

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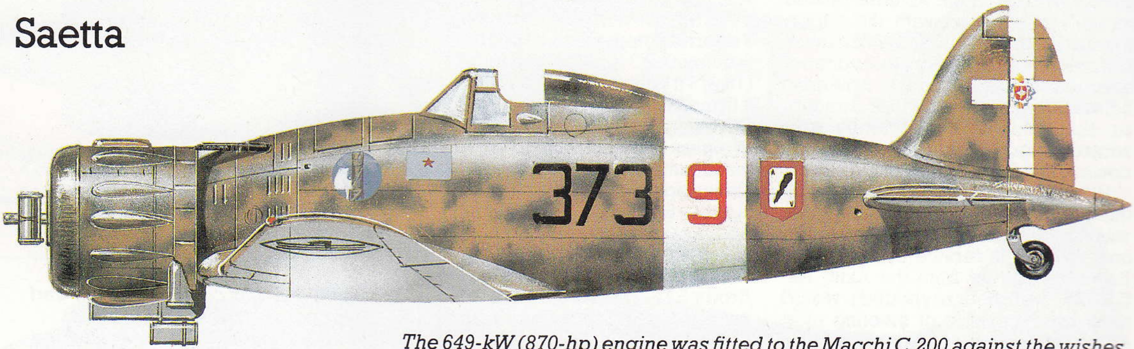
ITALY

Macchi C.200 Saetta



The 649-kW (870-hp) engine was fitted to the Macchi C.200 against the wishes of the designer Castoldi, and handicapped the aircraft in action with more powerful opponents such as the Hurricane and Kittyhawk.

Handicapped by Italy's pre-war lack of a powerful engine suitable for fighters, Mario Castoldi's radial-powered **Fiat C.200** was so underpowered and undergunned that when it arrived in service in 1939 it was already outclassed by the Hawker Hurricane which had joined the RAF two years earlier. Indeed the first C.200 unit, the 4° Stormo, expressed a preference for the CR.42 and accordingly reverted to the biplane in 1940. First flown on 24 December 1937 by Giuseppe Burei, the C.200, named the **Saetta** (lightning), went on to equip the 1°, 2°, 3°, 4° (in mid-1941) and 54° Stormi, and the 8°, 12°, 13°, 21° and 22° Gruppi, a total of about 1,200 aircraft being produced by Macchi, Breda and SAI Ambrosini. On the date that Italy entered the war, 10 June 1940, two home-based *stormi* were combat-ready with the C.200, being first flown in action over Malta in September that year, and it was largely the losses suffered by the Italian fighter arm at this time and during the Greek campaign that prompted the Luftwaffe to deploy X Fliegerkorps in the Mediterranean to bolster the Regia Aeronautica's flagging resources. C.200s were heavily committed in North Africa, and were fairly evenly matched with the early Hurricane Mk Is, weighed down by tropical air filters, but the attrition suffered by all Italian air force units (principally through poor serviceability and air attacks on their airfields) quickly reduced the number of C.200s. Some 51 Saettas of the 22° Gruppo operated in the Odessa zone of the Eastern Front from August 1941 onwards, proving capable of matching the older Soviet fighters in the early stages of that campaign. By the time of the Italian armistice in September 1943, however, the Regia Aeronautica's total inventory of serviceable C.200s stood at only 33.

Specification

Macchi C.200 Saetta (Breda-built Series 6)

Type: single-seat fighter/fighter-bomber

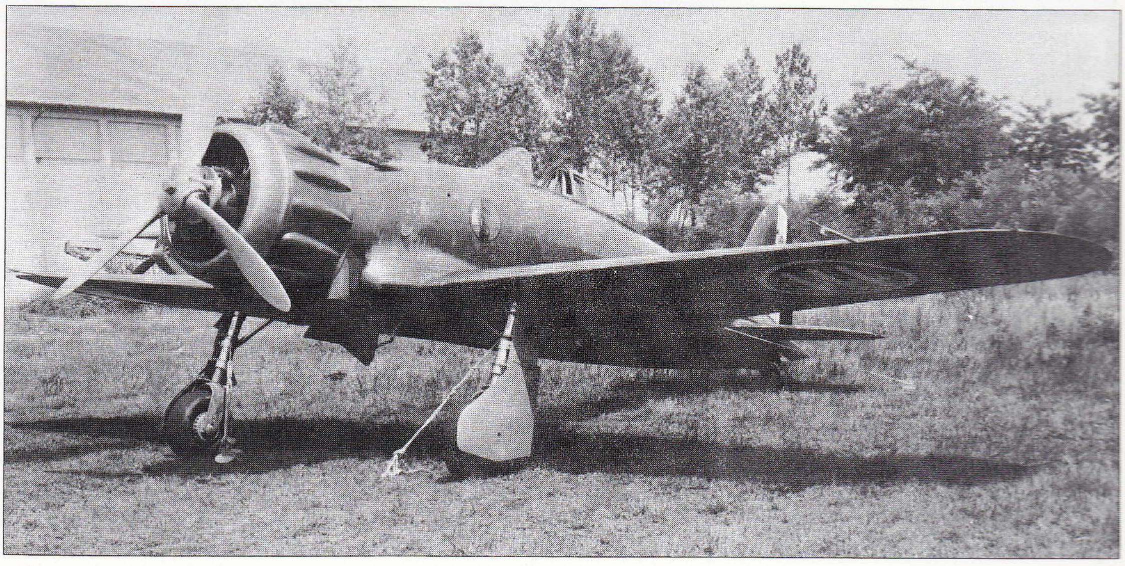
Powerplant: one 649-kW (870-hp) Fiat A 74 RC 38 radial piston engine

Performance: maximum speed 504 km/h (313 mph) at 4500 m (14,764 ft); climb to 4000 m (13,123 ft) in 4.55 minutes; service ceiling 8900 m (29,199 ft); range 570 km (354 miles)

Weights: empty 1960 kg (4,321 lb); maximum take-off 2395 kg (5,280 lb)

Dimensions: span 10.58 m (34 ft 8.5 in); length 8.25 m (27 ft 0.8 in); height 3.05 m (10 ft 0.1 in); wing area 16.80 m^2 (180.8 sq ft)

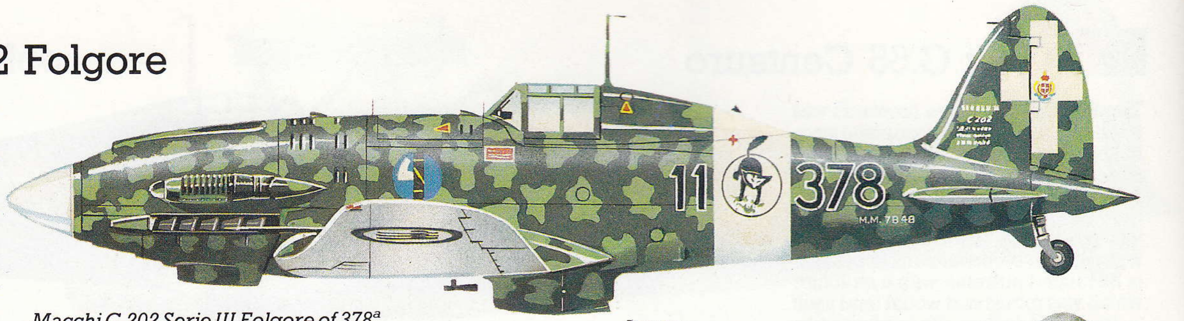
Armament: two 12.7-mm (0.5-in) Breda-SAFAT machine-guns in nose, plus provision for two 150-kg (331-lb) bombs



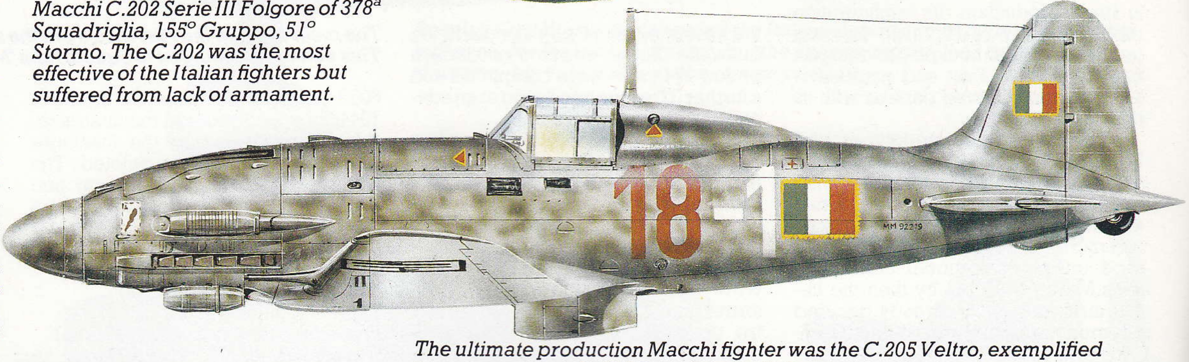
The C.200 Saettas saw their first combat over Malta in 1940 and were subsequently deployed to North Africa, where they held their own against Hurricane Mk Is encumbered by tropical air filters. But their numbers were rapidly reduced by poor maintenance and British air attacks.

ITALY

Macchi C.202 Folgore



Macchi C.202 Serie III Folgore of 378ª Squadriglia, 155° Gruppo, 51° Stormo. The C.202 was the most effective of the Italian fighters but suffered from lack of armament.



The ultimate production Macchi fighter was the C.205 Veltro, exemplified here by an aircraft of 1ª Squadriglia, 1° Gruppo.

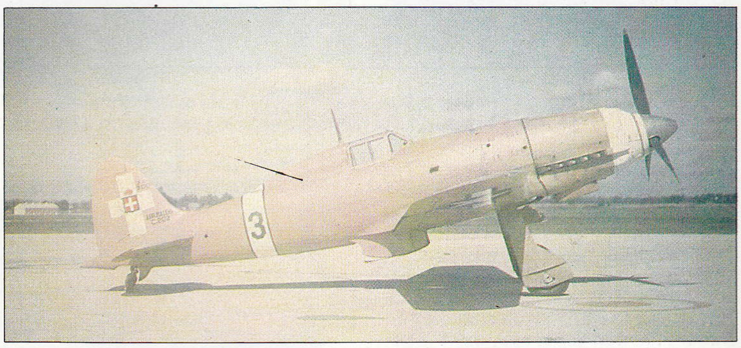
One of the best Italian fighters of the mid-war years, Mario Castoldi's **Macchi C.202 Folgore** (thunderbolt) was developed from the radial-engined C.200, but was powered by a Daimler-Benz DB 601 produced under licence as the Alfa Romeo RA 1000 RC 411. First flown by Carestiato on 10 August 1940, the **C.202 Series 1** production version entered service with the 1° Stormo at Udine in the summer of 1941, this unit arriving in Libya in the following November. The Folgore was a low-wing monoplane with inward-retracting landing gear and an armament of two 12.7-mm (0.5-in) Breda-SAFAT machine-guns in the nose; there was also provision for two 7.7-mm (0.303-in) guns in the wings. Engine production was slow and severely delayed the build-up of the Folgore in service.

The aircraft underwent very little change and development during its life span, and was produced in 11 series. It eventually served with 45 *Squadriglie* of the 1°, 2°, 3°, 4°, 51°, 52°, 53° and 54° Stormi in North Africa, Sicily, Italy, the Aegean and Russia. Production amounted to about 1,500, of which 392 were produced by the parent company and the remainder by Breda. In combat the Folgore proved to be well-matched with the Supermarine Spitfire Mk V in performance, but was badly undergunned and, although slightly superior to American fighters such as the Bell P-39 Airacobra, this armament deficiency prevented Folgore pilots from knocking down many Allied bombers.

Ultimate wartime development of the C.200/202 series of Italian fighters was the Daimler Benz-powered **C.205**; only 66 were in service by the time of Italy's withdrawal from the Axis. The **C.205V Veltro** (greyhound) would have been capable of meeting most Allied fighters on equal terms.

Specification
Macchi C.202 Series IX Folgore

Type: single-seat fighter
Powerplant: one 802-kW (1,075-hp) Alfa Romeo RA 1000 RC 411 12-cylinder inverted-Vee piston engine
Performance: maximum speed 600 km/h (373 mph) at 5600 m (18,373 ft); climb to 5000 m (16,404 ft) in 4.6 minutes; service ceiling 11500 m (37,730 ft); range 610 km (379 miles)
Weights: empty 2490 kg (5,490 lb); maximum take-off 2930 kg (6,460 lb)
Dimensions: span 10.58 m (34 ft 8.5 in); length 8.85 m (29 ft 0.4 in); height 3.50 m (11 ft 5.8 in); wing area 16.80 m^2 (180.8 sq ft)
Armament: two 12.7-mm (0.5-in) Breda-SAFAT machine-guns in the nose, plus provision for two 7.7-mm (0.303-in) guns in the wings

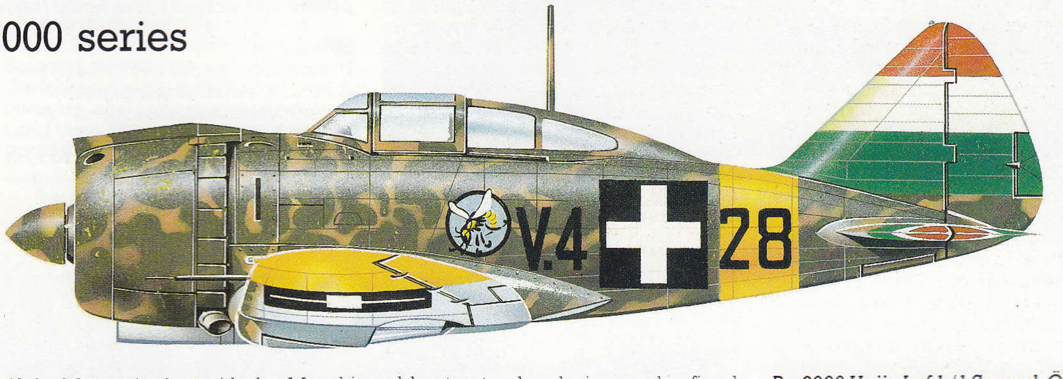


This C.202 was captured in Italy and transported to Wright-Patterson Field at Dayton, Ohio, for evaluation.

C.202s saw action in North Africa, Italy and on the Eastern Front.

ITALY

Reggiane Re.2000 series



Re.2000 Hejja I of 1./1 Szazad, Önallo Vadász Ostály (Independent Fighter Group) attached to the Hungarian army fighting in the USSR in 1942.

Officine Meccaniche Reggiane SA began development of a single-seat fighter which was based very closely on the US Seversky Aircraft Corporation's P-35 designed by Alexander Kartveli. Competitive evaluation against the Macchi MC.200 resulted in this latter aircraft being ordered into production for the Regia Aeronautica, although the **Reggiane Re.2000** had shown itself to be superior in manoeuvrability, even when flown against the Messerschmitt Bf 109E. The type was ordered by the Hungarian government, which also acquired a manufacturing licence. Re.2000s were supplied also to Sweden, being operated until 1945 by the Flygvapen under the designation **J 20**. And though rejected by the Regia Aeronautica, the Italian navy acquired 12 **Re.2000 Serie II** fighters especially strengthened for catapult launching, followed by 24 **Re.2000 Serie III** aircraft with increased fuel capacity for deployment as long-range fighters.

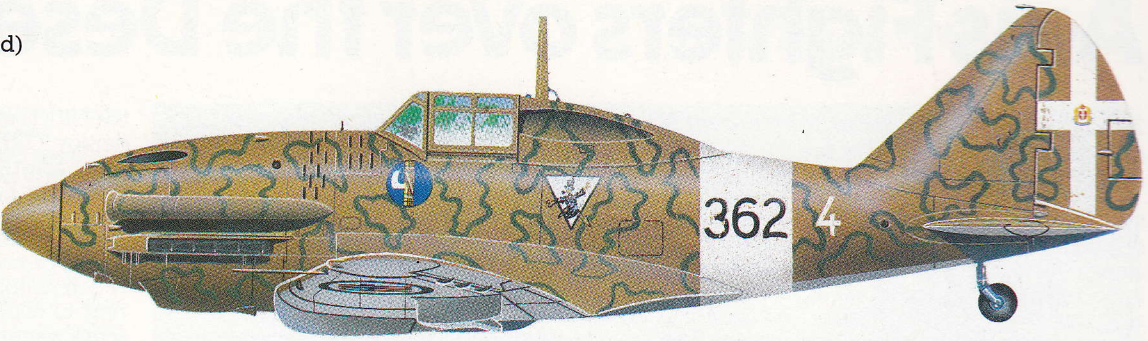
Installation of the Daimler-Benz DB 601A-1 engine led to the **Re.2001 Falco II**, first used operationally by the Regia Aeronautica over Malta in 1942. Luftwaffe priorities for DB 601 engines meant that the Re.2001 had to be powered by a licence-built version of this engine, the Alfa Romeo RA.1000 RC 41-1a Monsonie, but with the Macchi MC.202 having first call on production of these engines the manufacture of Re.2001s was limited to only 252.

About 50 **Re.2002 Ariete** (ram) fighter-bombers followed for service with the Regia Aeronautica, these being powered by the 876-kW (1,175-hp) Piaggio P.XIX RC 45 radial engine mounted in a slightly lengthened and strengthened fuselage. The type first saw operational service in 1942, suffering heavy losses while contesting the Allied landings on Sicily. Last of this related family of fighters, and one of the best produced in Italy during World War II, the **Re.2005 Sagittario** (archer) had the same general configuration as its predecessors. However, its design incorporated considerable structural redesign, and refined landing gear, and the type reverted to the inline engine. First flown in September 1942 with a Daimler-Benz DB 605A-1, the Re.2005 led to a production model, of which deliveries began in 1943, with a licence-built version of this engine, the Fiat RA.1050 RC 58 Tifone. Only 48 had been delivered before finalisation of the armistice with the Allies, these aircraft fighting in the defence of Naples, Rome and Sicily, the survivors battling above the crumbling ruins of Berlin.

Specification
Reggiane Re.2005 Sagittario

Type: single-seat fighter/fighter-bomber
Powerplant: one 1100-kW (1,475-hp) Fiat RA.1050 RC 58 Tifone 12-cylinder inverted Vee piston engine
Performance: maximum speed 630 km/h (391 mph) at 6950 m (22,802 ft); climb to 2000 m (6,562 ft) in 1.58 minutes; service ceiling 12190 m (39,993 ft); range 1265 km (786 miles)
Weights: empty 2600 kg (5,732 lb); maximum take-off 3560 kg (7,848 lb)
Dimensions: span 11.00 m (36 ft 1.1 in); length 8.73 m (28 ft 7.7 in); height 3.15 m (10 ft 4 in); wing area 20.40 m^2 (219.59 sq ft)

Reggiane Re.2000 series (continued)



Reggiane Re.2001 of the 362ª Squadriglia, 22° Gruppo, 52° Stormo at Capodichino in May 1943. The DB 601 engine was licence-built by Alfa Romeo.

Armament: three 20-mm cannon and two 12.7-mm (0.5-in) machine-guns, all forward-firing, plus up to 630 kg (1,389 lb) of bombs when operated as a fighter-bomber

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GERMANY

Focke-Wulf Fw 190

Proposed in 1937, as the Bf 109 was joining the Luftwaffe, Kurt Tank's **Focke-Wulf Fw 190** surprisingly featured a large air-cooled BMW radial engine. First flown on 1 June 1939, the prototype was followed by short- and long-span pre-production **Fw 190A-0** aircraft with BMW 801 14-cylinder radials. The long-span version was selected for production. **Fw 190A-1** fighters joined the Luftwaffe in mid-1941 and proved superior to the Spitfire Mk V. A-series variations included the **Fw 190A-3** with BMW 801D-2 and two 7.92-mm (0.31-in) and four 20-mm guns, the **Fw 190A-4** with water-methanol power-boosting (with fighter-bomber, bomber-destroyer and tropicalized sub-variants). The **Fw 190A-5** featured a slightly lengthened nose and sub-variants included versions with six 30-mm guns (**A-5/U12**) and torpedo-fighters (**A-5/U14** and **U15**). The **Fw 190A-7** and **Fw 190A-8** entered production in December 1943 and featured increased armament and armour. The **Fw 190A-8/U1** was a two-seat conversion trainer. The next main production version, the **Fw 190D**, featured a lengthened nose and Junkers Jumo 213 liquid-cooled engine in an annular cowling. The **Fw 190D-9** was the main service version, which joined the Luftwaffe in the autumn of 1944, and was generally regarded as Germany's best wartime piston-engine fighter; with a top speed of 685 km/h (426 mph), it was armed with two cannon and two machine-guns, and was powered by a water-methanol boosted 1670-kW (2,240-hp) Jumo 213A engine. Other late versions included the **Fw 190F** and **Fw 190G** specialized ground-attack fighter-bombers capable of carrying up to 1800 kg (3,968 lb) of bombs.

A development of the Fw 190D was the long-span **Focke-Wulf Ta 152** with increased armament and boosted Jumo 213E/B (top speed 760 km/h; 472 mph at 12500 m/41,010 ft); a small number of **Ta 152H-1** fighters reached the Luftwaffe shortly before the end of the war.

Specification

Focke-Wulf 190A-8

Type: single-seat fighter

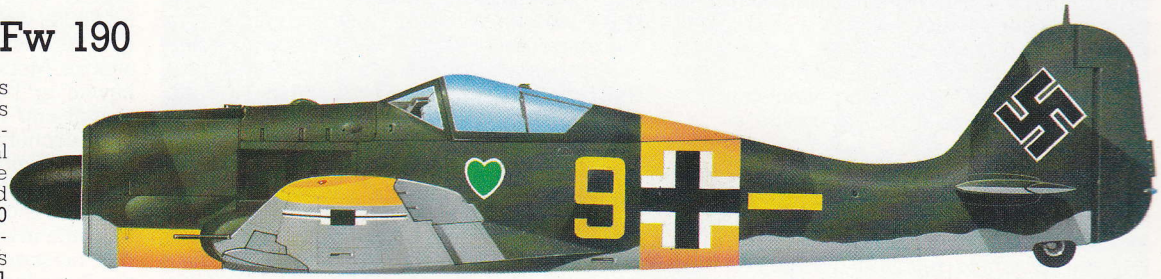
Powerplant: one 1566-kW (2,100-hp) BMW 801D-2 radial piston engine with water-methanol boosting

Performance: maximum speed 654 km/h (406 mph) at 6000 m (19,685 ft); initial climb rate 720 m (2,362 ft) per minute; service ceiling 11400 m (37,402 ft); normal range 805 km (500 miles)

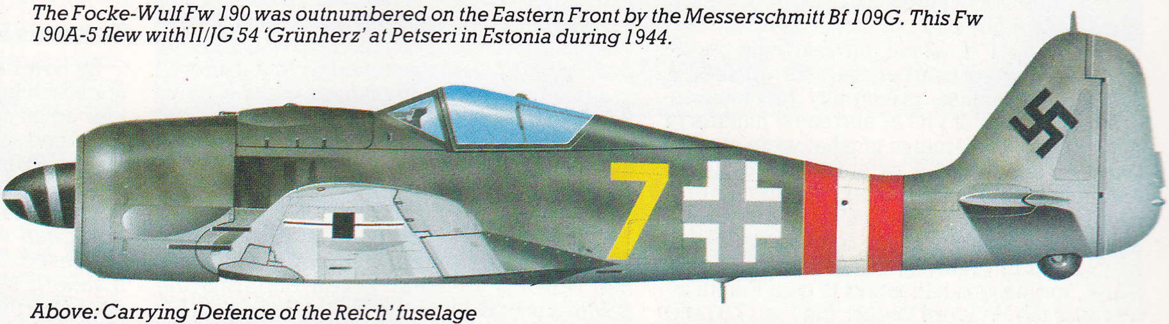
Weights: empty 3170 kg (6,989 lb); maximum take-off 4900 kg (10,803 lb)

Dimensions: span 10.50 m (34 ft 5.4 in); length 8.84 m (29 ft 0 in); height 3.96 m (13 ft 0 in); wing area 18.30 m^2 (196.99 sq ft)

Armament: two 7.92-mm (0.31-in) guns in nose and up to four 20-mm guns in wings, plus provision for wide range of underfuselage and underwing bombs, guns and rockets

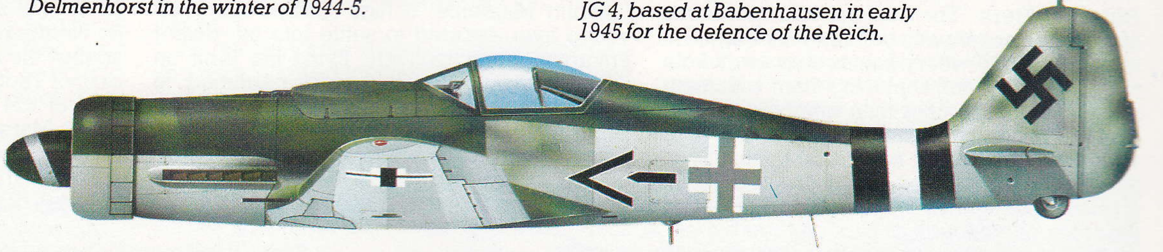


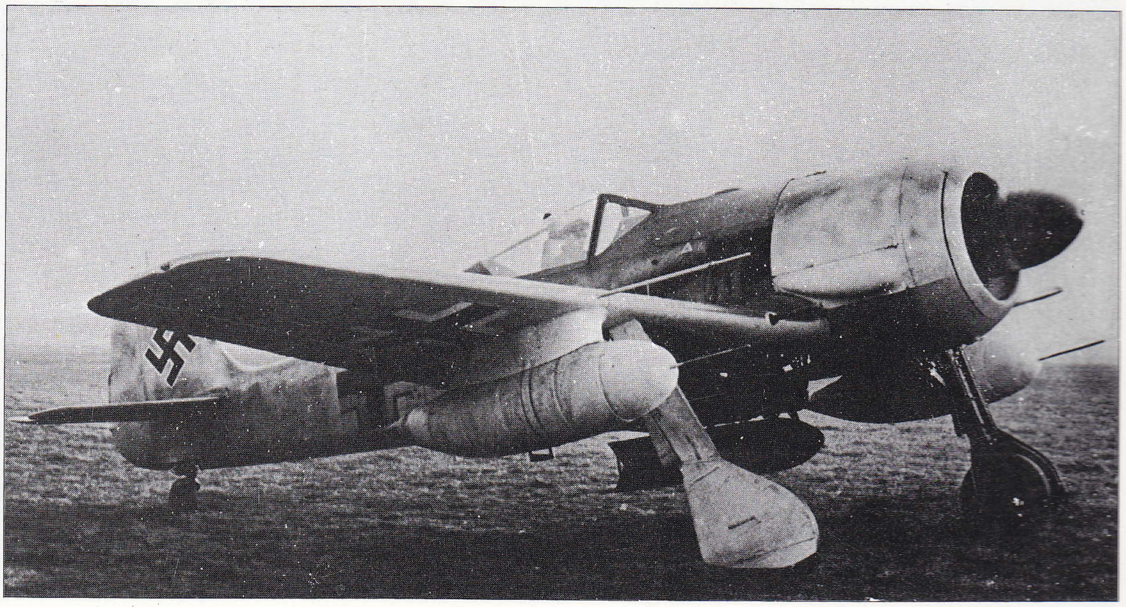
The Focke-Wulf Fw 190 was outnumbered on the Eastern Front by the Messerschmitt Bf 109G. This Fw 190A-5 flew with II/JG 54 'Grünherz' at Petseri in Estonia during 1944.



Above: Carrying 'Defence of the Reich' fuselage bands, this Fw 190A-9 flew with I/JG 6 at Delmenhorst in the winter of 1944-5.

Below: Fw 190D-9 ('Dora-9') of Stab/JG 4, based at Babenhausen in early 1945 for the defence of the Reich.





The Fw 190G-2 was a specialized ground attack version with wing racks for bombs or tanks, and an ETC 501 centreline rack for a 1800-kg (3,968-lb) bomb (in this case an SC 500 500-kg/1,102-lb bomb is carried). Strengthened landing gear was necessary for the heaviest load.

Axis Fighters over the Desert

The appearance of German fighters over North Africa had as dramatic an effect on the campaign as the arrival of the Afrika Korps. In just six weeks the pilots of I/JG 27 had destroyed as many Allied aircraft as had the Italians in the previous eight months.

The air war over North Africa occupied a total of almost exactly three years, between the summer of 1940 and that of 1943. At the outset an impoverished RAF, equipped in the main with a fighter force of a few Gloster Gladiator biplanes, faced Italy's equally obsolescent Fiat CR.42s. On the relatively infrequent occasions these protagonists met, honours were roughly even; by and large the Regia Aeronautica pilots were skilled fliers, the tactical balance between the two sides being maintained by the more aggressive attitude to combat among the RAF pilots.

The campaigns in Greece and Crete not only severely weakened the RAF by diverting its limited resources away from the Western Desert, but also delayed its build-up of Hawker Hurricanes, which reached the theatre only after a roundabout journey by sea from the UK and a long flight up from the Gold Coast.

Early in 1941, however, the Luftwaffe began deploying a small number of modern aircraft in the Mediterranean, principally the Messerschmitt Bf 109Es of I/JG 27 and some Junkers Ju 87s, to support elements of what were soon to become famous as Erwin Rommel's Afrika Korps, presumably distrusting the Regia Aeronautica's ability to do so. Certainly, faced with aircraft like the Hurricane and Curtiss Tomahawk equipping six squadrons of the RAF and SAAF, the Italians had failed to gain the initiative over the Western Desert, the Fiat G.50 and Macchi C.200 proving somewhat inferior to the Allied fighters. The Italians had moreover adopted a dangerously debilitating practice of rotating combat-weary fighter units away from the war theatre and replacing them with inexperienced units, rather than simply resting individual pilots in turn for short periods. There was therefore little or no tactical continuity in the front line, with the result that few really accomplished Italian fighter pilots remained at the front long enough to pass on their experience to newcomers. As a further consequence Italian combat tactics that were already becoming outmoded in 1940 were still being taught at the training schools in 1941, and persisted at the front until 1942, by which time the improved Macchi C.202 itself engendered considerable changes in Italian fighter tactics by reason of its enhanced performance. By then the cream of the fighter pilots had already fallen in battle.

By contrast the German Bf 109E pilots of I/JG 27, led by Eduard Neumann, were exuding self-confidence when they arrived in the Mediterranean early in 1941. With such *Staffelkapitäne* (squadron leaders) as Karl-Wolfgang Redlich (1.Staffel) and Gerhard Homuth (3.Staffel), both veterans of the Battle of Britain who were later to receive the Knight's Cross, the *Gruppe* entered combat on 19 April, shooting down a Hurricane over Gazala, and claiming a Vickers Wellington the following day. Thereafter success followed quickly, the Bf 109E suffering less drag penalty from its dust filter than did the Hurricane, whose bulky Vokes filter reduced its top speed to little over 480 km/h (300 mph). Within six weeks the 37 pilots of I/JG 27 had destroyed 63 Allied aircraft in air combat, almost as many as had the entire Italian fighter force in North Africa in eight months; their own losses amounted to six killed and two wounded.

Arrival of Marseille

Among the pilots on JG 27's 3.Staffel was a 22-year-old Berlin-born *Oberfähnrich*, who had already claimed seven Supermarine Spitfires shot down while flying 'Emils' with LG 2 and JG 52 over the English Channel. Hans-Joachim Marseille, a high-spirited extrovert young man, seemed to settle into the desert environment instinctively, flying his 'Emil' on solo practice sorties, whenever permitted, in order to perfect his skill and become a highly proficient marksman. Strangely, however, Marseille was unfortunate in seldom being included in sorties by his *Staffel* when the biggest fights took place, and his personal victory score increased only slowly during the first six months.

In the meantime, as the land battle increased in ferocity, the Afrika Korps grew in strength and the opposing armies advanced and retreated across the breadth of Cyrenaica in 1941, the OKL (Luftwaffe high command) decided to deploy JG 27's other two *Gruppen* to Libya from the Eastern Front. By now the entire *Geschwader* had been re-equipped with the Bf 109F, although many of its pilots still professed a preference for the old 'Emil'. Not so Marseille, whose prowess as a marksman seemed entirely compatible with the slightly steadier 'Friedrich' in combat. By the beginning of 1942 his score was around 50 and beginning to increase rapidly. On 3 June, while escorting some Ju 87s, his *Staffel* was attacked by a formation of P-40s. In a series of beautifully executed quarter attacks Marseille destroyed six of the Kittyhawks in 11 minutes, using only 10 20-mm rounds and 180 from his MG17 machine-guns. Such economy of ammunition was reminiscent of René Fonck, the French ace of World War I. A fortnight later, flying his 'Yellow 14' from Gazala, he despatched six more RAF aircraft, this time in an even six minutes. The following day, his score standing at 101, he was awarded the Swords to his Knight's Cross.

Towards El Alamein

By now both sides in the desert battle were approaching a climax in North Africa as Rommel advanced towards the spot on the map identified as El Alamein. Daily the Ju 87s attacked the Tobruk garrison as the hard-worked pilots of JG 27 kept watch for patrolling Allied fighters. Marseille had now taken over as *Staffelkapitän* of 3.Staffel, Homuth having been appointed *Gruppenkommandeur* (wing commander). By now Spitfire Mk Vs had started appearing in the skies over Africa.

The first day of September 1942 was to see JG 27 at its zenith of achievement. On that day, as Nehring's tanks continued their battering against the Allied positions at El Alamein, aircraft of Tedder's Middle East Command flew a total of 674 sorties to protect the British 8th Army. Marseille himself flew three times in the course of the day. On his first patrol he ran into a large group of Kittyhawks and Spitfires, shooting down three of the former and a Spitfire

Operations in the desert had advantages and disadvantages. Owing to the vast areas of hard, flat sand, there was little need to build airstrips; however, the ubiquitous dust caused problems with engines and armament.

The Bf 110 was widely used in the desert, where its long range, twin-engined safety and heavy armament made it a useful asset. It could easily carry reconnaissance cameras, and this example is being loaded for a reconnaissance sortie.

between 08.26 and 08.39, all south-east of Imayid. Two hours later he was airborne once more on a patrol behind the Allied lines when his *Gruppe* engaged a wing of Kittyhawks, Marseille alone shooting down eight between 10.55 and 11.05 near Alam el Halfa. In the late evening the same day, once more patrolling Imayid, Marseille accompanied his *Gruppe* against a wing of Hurricanes and Kittyhawks, this time claiming five of the American fighters between 17.47 and 17.53. In the course of that day JG 27 destroyed 20 Kittyhawks, four Hurricanes and two Spitfires for the loss of one pilot killed, one taken prisoner and one posted missing.

Seventeen in a day

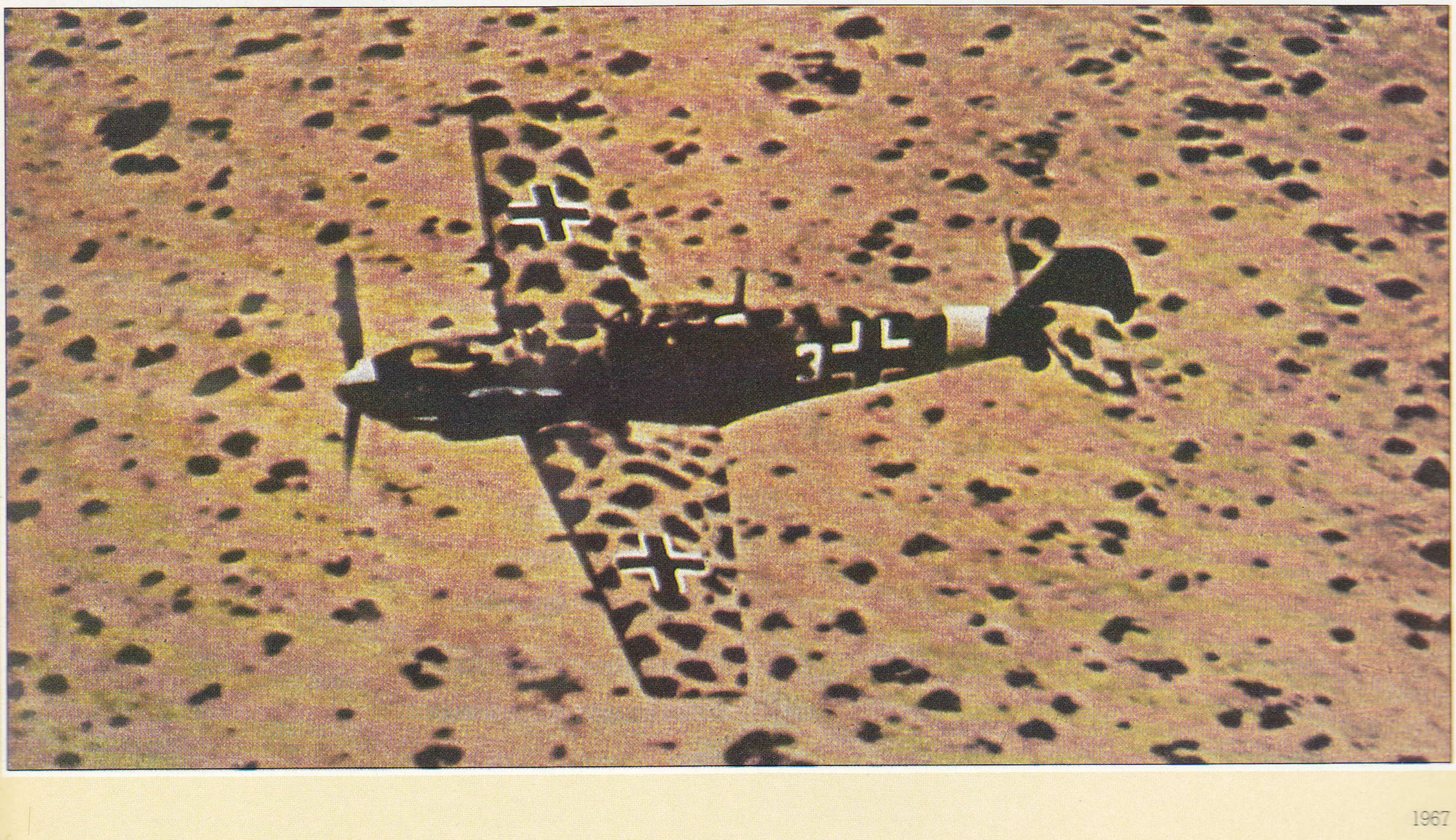
Marseille's feat of shooting down 17 Allied fighters in a single day (all of which are identifiable in Allied records) brought immediate congratulations from Generalfeldmarschall Kesselring himself, and the award of the Diamonds on the next day. On 15 September he reached a score of 150 victories when he shot down seven Allied aircraft in 11 minutes.

On the morning of 30 September, now flying a Bf 109G-2 near Imayid, Marseille was heard on his radio to report that his engine had caught fire and that his cockpit was filled with smoke. A few minutes later he called to report that he was baling out in the vicinity of Alamein. His wingman, Pöttgen, reported seeing Marseille leave his cockpit but saw his parachute snag the tailplane, adding as the 'Gustav' dived into the ground and blew up, simply *'Er ist tot'* (he is dead).

The effect of Marseille's death upon the Luftwaffe in North Africa was extraordinary. That is not to say the loss of this one man significantly influenced the course of events at El Alamein or afterwards, yet it should be recalled that JG 27 represented the elite among Axis fighter forces in North Africa, and the loss of Marseille certainly had a profound effect upon the other young pilots of the *Geschwader*, the more so as it had been suffered accidentally and unnecessarily.

As the two great Allied advances from east and west followed the final battle at El Alamein and the 'Torch' landings, JG 27 and all the other Axis forces scrambled back to the final toehold in Tunisia, never again to reap such prolific harvests in air combat. Marseille's own I Gruppe was withdrawn from Africa to western Europe in November, although the II and III Gruppen stayed in Africa to the end. No matter how much the Luftwaffe could scrape together by way of reinforcements, the final outcome was inevitable in the face of enormous Allied air superiority.

Throughout the war the Luftwaffe was a master of aircraft camouflage, and this Bf 109E is a perfect example. Following the failure of the Regia Aeronautica to gain air superiority, the influx of Bf 109s to the desert was a welcome sight for Axis forces.



Messerschmitt Bf 109 in Action

The story of the Bf 109 parallels that of the Luftwaffe itself; after dramatic success on the Continent it had to fight over England in a manner unsuited to its abilities, but then achieved further triumphs over the USSR and Africa. Later, as the Reich itself crumbled before the Allied onslaught, the Bf 109s fought their last battles against overwhelming numbers of enemy aircraft.

A Luftwaffe pilot climbs into his Bf 109E-1 at a German base just prior to hostilities in 1939. Over Poland the Bf 109s had complete superiority over the few PZL P.11s which rose to meet the lightning attack. The unit is 2./JG 20, which later became 8./JG 51.

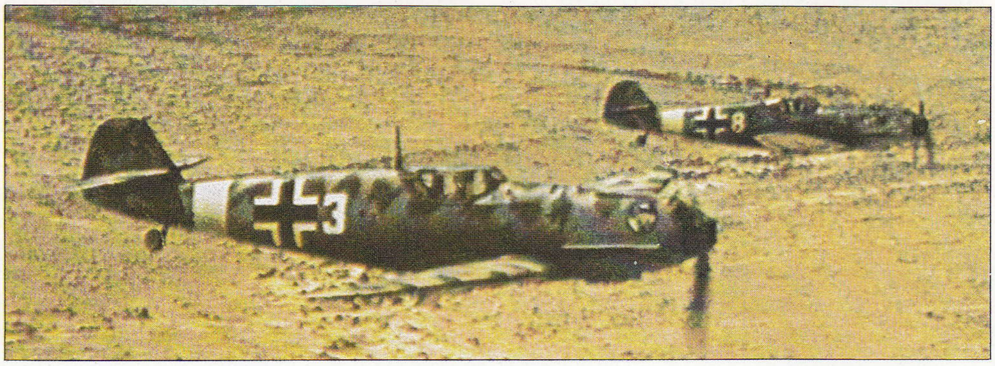
The summer of 1940 brought the Jagdverband with its 'Emils' (Messerschmitt Bf 109Es) to the Channel coast for what was widely believed would be Germany's last campaign before turning its attention towards the USSR. For the German fighter pilots the coming battle against the RAF's Supermarine Spitfires and Hawker Hurricanes would obviously be tough going, although the Battle of France had already confirmed the excellence of their aircraft.

However, as the weeks passed and the Dornier, Heinkel and Junkers bombers returned from their daily raids over southern England, their formations badly broken and with crippled aircraft struggling to reach the French coast, it was clear that Goering's elite *Zerstörer*, the big Messerschmitt Bf 110 escort fighter, was no match for the nimble Spitfires and Hurricanes. To its disgust and dismay the Jagdverband received orders from the OKL (Luftwaffe high command) in mid-August to the effect that henceforth its 'Emils' would accompany the bombers as close escort. No matter how such influential men as Galland and Mölders might argue that such tactics would deprive the Jagdverband of its supreme asset, that of meeting the RAF fighters in conditions of its own choice, Goering was adamant: the bombers must be protected.

For more than 10 days the *Jagdgeschwader* (fighter groups) were sent up to rendezvous with the great formations, using precious fuel to take position above and abeam the immaculate ranks of lumbering bombers as they flew northwards at scarcely 320 km/h (199 mph). Men whose instinct, selection and training for individual combat were now shackled to a ponderous procession saw the British fighters above them and could do little to redress the tactical balance. Even the eight-gun Hurricane, over which the 'Emil' possessed a 48-km/h (30-mph) speed advantage, constituted tough opponents as the RAF pilots dived through the *Staffel* (squadron) sections, and many of the promising young German pilots were shot down, unable to manoeuvre within the confines of their formation and under strict orders to remain with the bombers. And when they could engage in dogfighting, often well inland over southern England, their fuel reserves were already desperately low; once more, against all their instincts, they had to break off as fuel warning lights flickered on to remind them of a 20-minute return to France over the grey wastes of the English Channel.

Certainly the German pilots were shooting down RAF fighters but, in mid-August, there seemed to be no apparent weakening of the British air defence. Many of the RAF pilots were baling out or force landing over their own territory, to live and fight another day; others, short of fuel or out of ammunition, could disengage at will to land and replenish. Little wonder the Germans' morale was badly shaken.

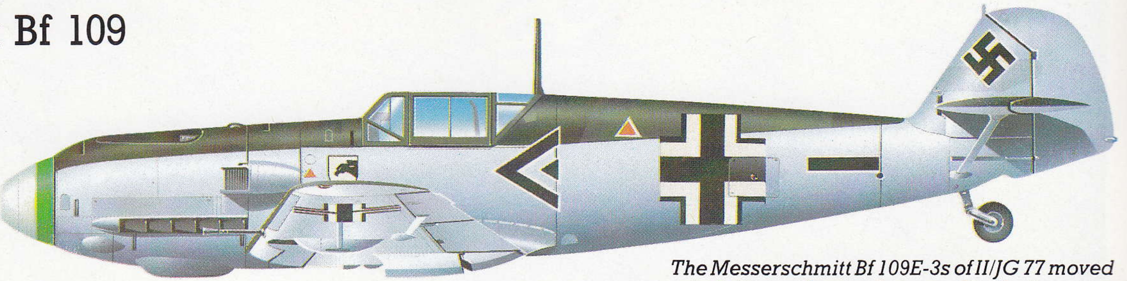
Then, almost certainly as the result of constant appeals by the fighter leaders, the *Jagdführer* (fighter leader) was allowed to rescind the former orders, and during the last week of August he decreed that, while on certain occasions the 'Emils' would still be required to accompany the bombers, they could also undertake *frei Jagd* (free chase) sweeps over southern England. At the same time large formations (often up to 100 fighters) would be sent out over Kent and Sussex, appearing on British radar as bombing raids, thereby en-



During the early months in the deserts of North Africa, the Bf 109 enjoyed considerable success. Opposition consisted mainly of Hawker Hurricanes and Curtiss Tomahawks and Kittyhawks. White Mediterranean theatre bands were carried by most aircraft.

GERMANY

Messerschmitt Bf 109



The Messerschmitt Bf 109E-3s of II/JG 77 moved into Aalborg, Denmark, soon after the invasion.

First flown in September 1935, Willy Messerschmitt's single-seat **Messerschmitt Bf 109** fighter saw action during the Spanish Civil War in the **Bf 109B** series version (Junkers Jumo 210 engine), joining the Luftwaffe in 1937 and being followed by the **Bf 109C** with armament increased from three to four rifle-calibre machine-guns. The **Bf 109D** introduced the Daimler-Benz DB 600 engine and hub-firing cannon, and was produced in 1938-9.

First major production variant was the **Bf 109E** with DB 601D engine and direct fuel-injection, and variations of armament between two machine-guns, and four machine-guns and one hub-cannon. Fighter-bomber and reconnaissance versions were produced during 1940. The Bf 109E was the Luftwaffe's principal fighter during 1939-40. It was followed by the **Bf 109F**, powered initially by the DB 601N and later the DB 601E, and introduced such equipment as nitrous-oxide power boosting, faster-firing guns (15-mm/0.59-in MG 151) and optional underwing gun pods. Both the Bf 109E and Bf 109F existed in tropicalized form for service in North Africa during 1941-2.

The **Bf 109G**, with DB 605 engine, served from 1942 until 1945 on all fronts, being built in the largest numbers and introducing armament variations which included 30-mm guns. Fastest of all was the **Bf 109G-10** (690 km/h; 429 mph). Final main production version was the **Bf 109K** with boosted versions of the DB 605. Other versions included the **Bf 109H** high-altitude fighter and **Bf 109T** shipboard fighter.

More than 33,000 Bf 109s were built between 1937 and 1945.

Specification
Messerschmitt Bf 109G-6

Type: single-seat interceptor fighter

Powerplant: one 1100-kW (1,475-hp) Daimler-Benz DB 605A 12-cylinder inverted-Vee piston engine

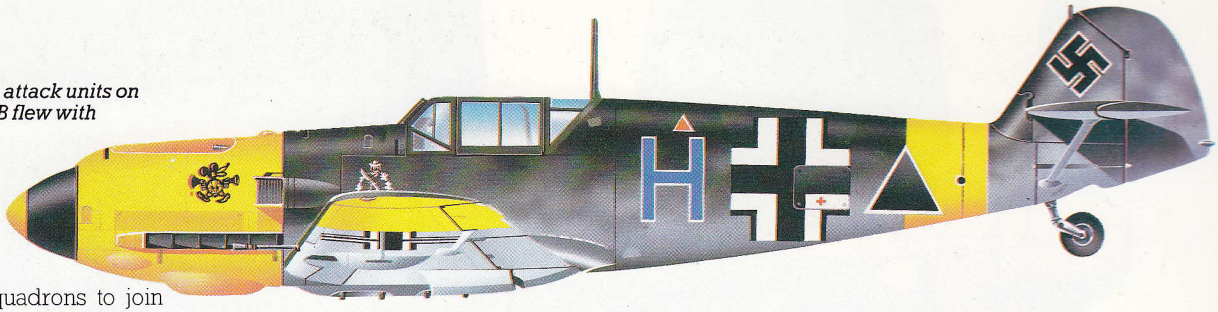
Performance: maximum speed 623 km/h (387 mph) at 7000 m (22,966 ft); climb to 6000 m (19,685 ft) in 6.0 minutes; service ceiling 11750 m (38,550 ft); normal range 725 km (450 miles)

Weights: empty 2700 kg (5,952 lb); maximum take-off 3150 kg (6,945 lb)

Dimensions: span 9.92 m (32 ft 6.6 in); length 9.02 m (29 ft 7.1 in); height 3.40 m (11 ft 1.9 in); wing area 16.05 m^2 (172.8 sq ft)

Armament: two nose-mounted 13-mm (0.59-in) MG 131 heavy machine-guns, one 30-mm MK 108 cannon firing through propeller hub and two 20-mm MG 151/20 cannon mounted under the wings

Bf 109s operated with the ground attack units on the Eastern Front. This Bf 109E-7/B flew with II/Schlachtgeschwader 1.



couraging the RAF fighter squadrons to join battle. These tactics at once turned the fortunes of the Jagdverband.

Often timed for take-off as a bombing raid approached the English coast, the free-chase *Staffeln* would sweep in low over the southern counties below the British radar, catching the Spitfires and Hurricanes as they climbed out of Kenley, Biggin Hill and Tangmere. Later, other groups of 'Emils' would pounce on the weary RAF pilots as they returned from combat, short of fuel and with little or no ammunition remaining.

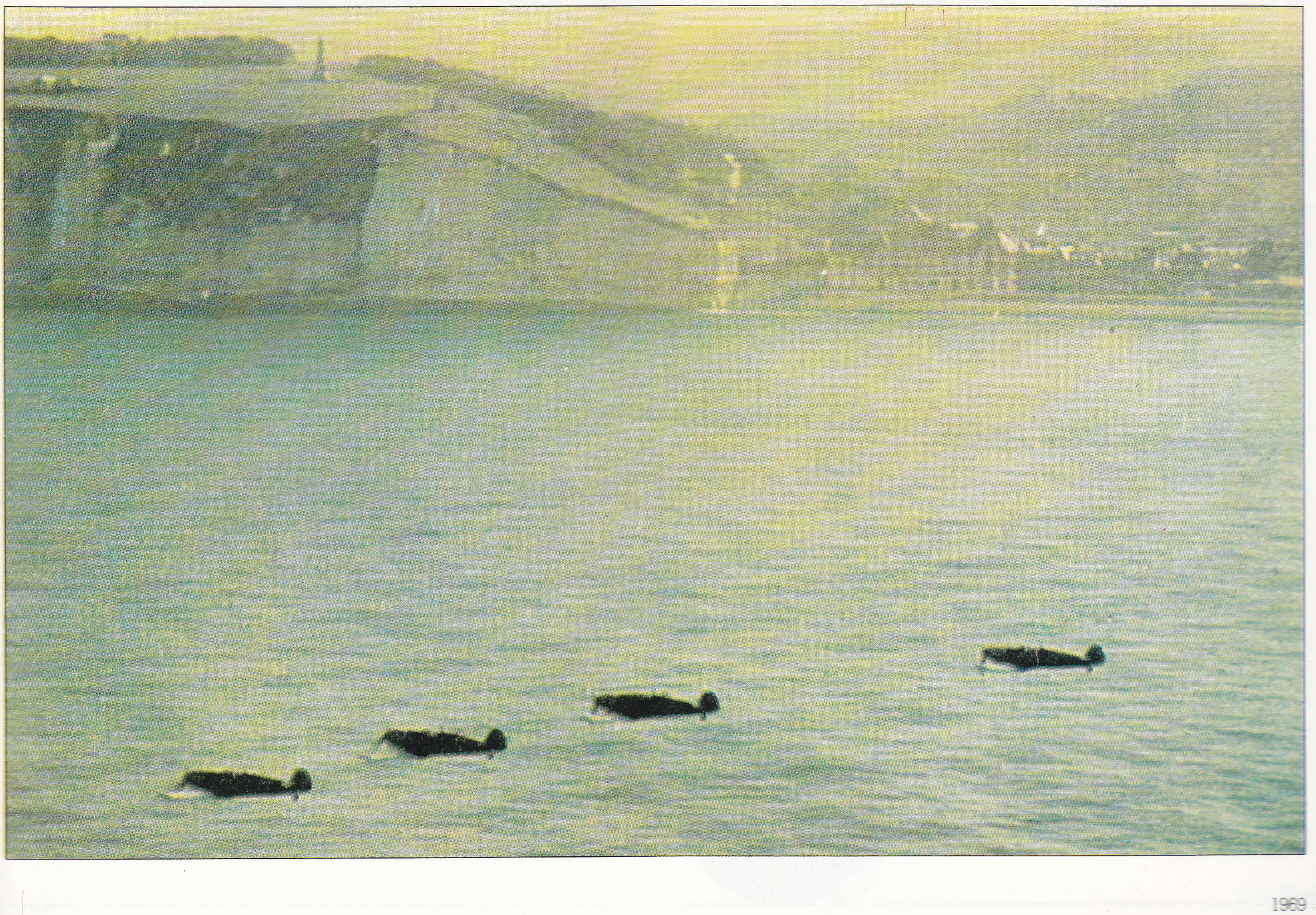
On 26 August RAF fighter losses rose to 27 Spitfires, Hurricanes and Boulton Paul Defiants, compared with 15 'Emils'; on 30 August the British lost 21 fighters, the Jagdverband 12. In the first week of September the fortunes swung even more heavily against Fighter Command with 15 RAF fighters shot down compared with only two 'Emils' lost in combat on 1 September; on 3 September 13 British and three 'Emils', the next day 17 British and five Bf 109s. In a fortnight RAF Fighter Command lost the equivalent of about 20 squadrons. Yet once again the German high command stepped in, this time switching the might of the Luftwaffe from attacks on the British defence system to those on London and the civilian population. At just the moment when the Jagdverband had it in its power to destroy RAF Fighter Command within a matter of weeks, Goering denied his own pilots the opportunity of a crushing victory.

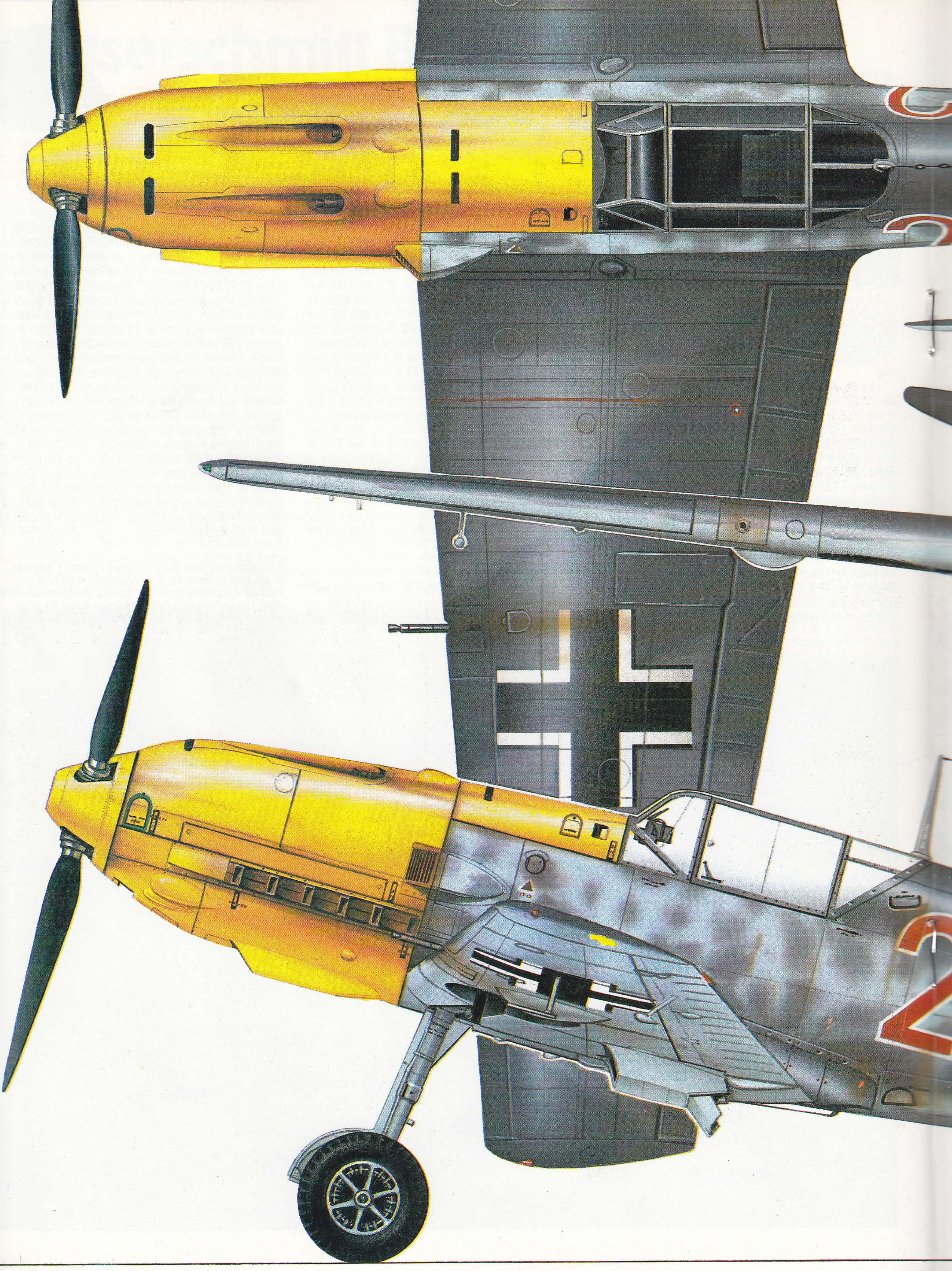
As the daylight Battle of Britain was coming to an end a new version of the Bf 109 was already being tested in Germany and this, the Bf 109F 'Friedrich' with 969-kW (1,300-hp) DB 601E engine, entered Luftwaffe service during the spring of 1941 in time to equip six *Gruppen* (wings) for Hitler's attack on the USSR. Once more the Jagdverband was able to revert to its traditional role as a battlefield support force, and the first 72 hours of the great attack eastwards constituted the most extraordinary rampage by fighter aircraft in history. No fewer than 830 Bf 109s were deployed on Polish, Hungarian and Romanian airfields, few of which were more than 100 km (62 miles) from the front line; moreover, simple modifications had been introduced to enable the German fighters to mount carriers for up to 20 small SD 2 fragmentation bombs with which to attack ground targets.

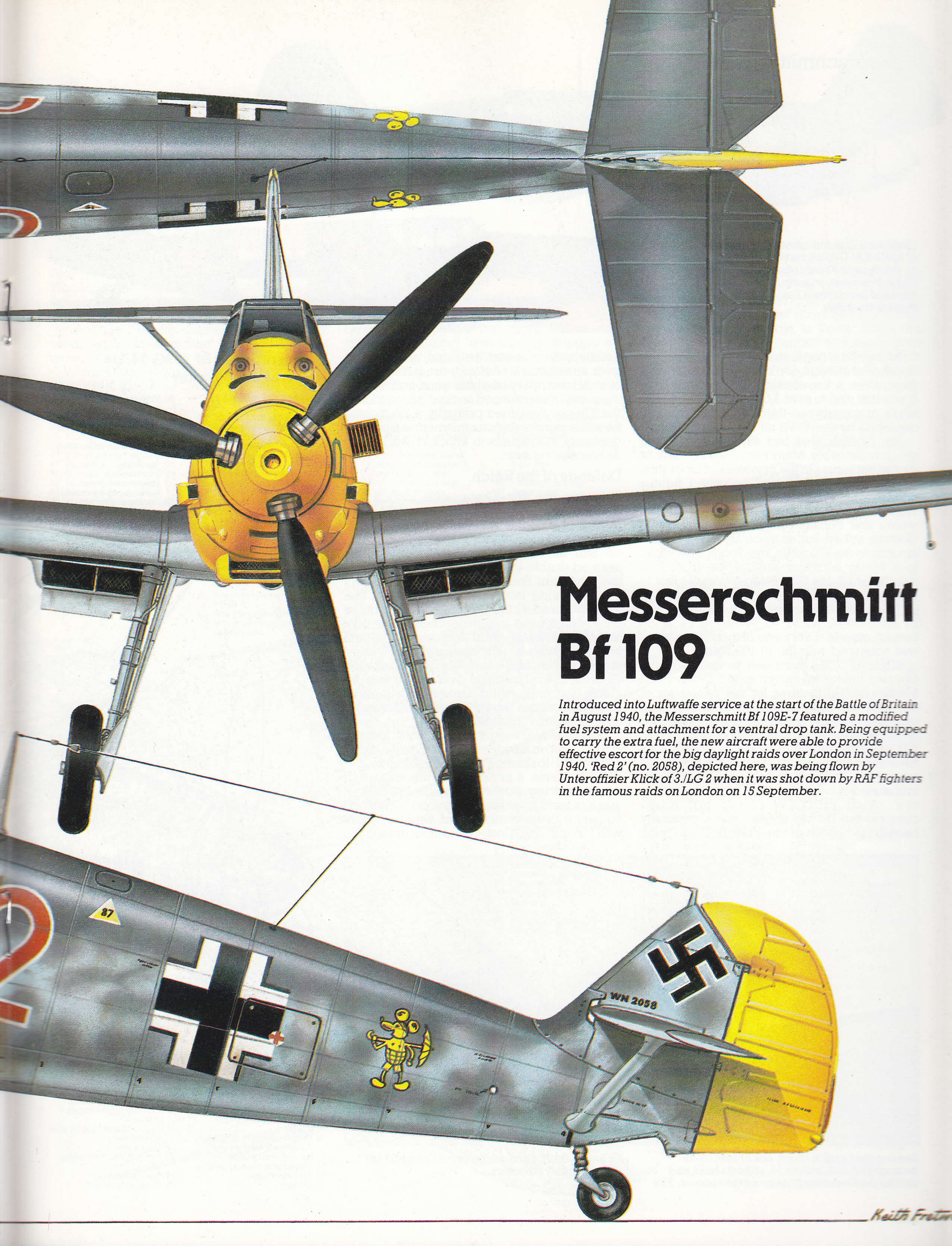
Light armament

The gun armament of the Bf 109F, criticized by many *Jagdflieger* (fighter pilots) as inadequate for air combat, remained relatively light, consisting of just two rifle-calibre machine-guns plus a single heavy machine-gun of 15-mm (0.59-in) calibre or a 20-mm cannon firing through the propeller hub. When at dawn on 22 June 1941 the Luftwaffe's fighters and bombers took to the air en masse from more than 60 airfields, and began systematically to strafe and bomb every airfield of the Soviets' V-VS within 130 km (80 miles) of the front, scarcely a single Soviet aircraft rose to meet them. In this, the greatest-ever pre-emptive air strike, the carnage among Soviet aircraft was enormous. Within six hours more than 800 lay scattered and wrecked on Soviet fields, the majority irreparably crippled by the highly-effective German fragmentation bomblets. The light gun armament of the 'Emils' and 'Friedrichs' proved perfectly adequate to dispose of such Soviet fighters that attempted to interfere with the raids, the majority of them the nimble but outdated Polikarpov I-15bis and I-153 biplanes and I-16 monoplanes.

A Schwarm *of four 'Emils' pass a French Channel town. Led by men such as Mölders, who had racked up great expertise during the Spanish Civil War, the Luftwaffe's fighter tactics were far in advance of those of France and Britain.*



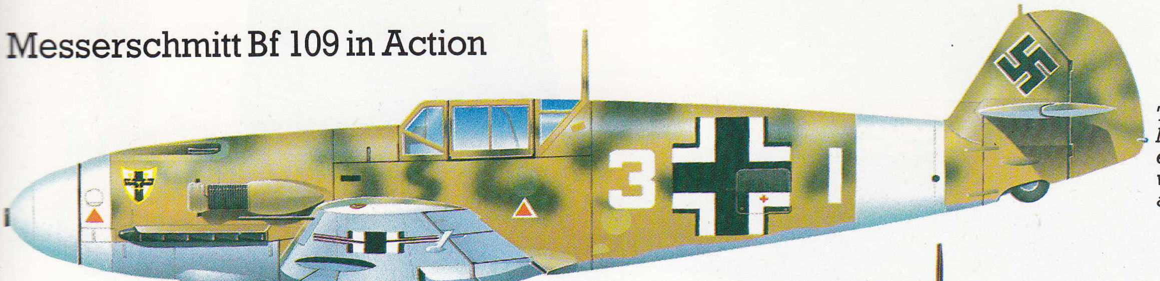




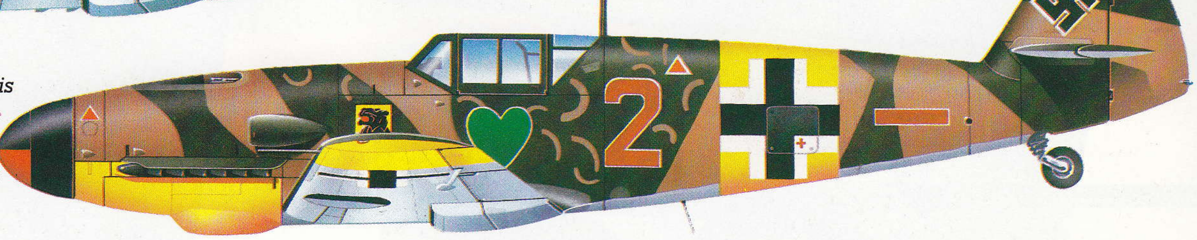
Messerschmitt Bf 109

Introduced into Luftwaffe service at the start of the Battle of Britain in August 1940, the Messerschmitt Bf 109E-7 featured a modified fuel system and attachment for a ventral drop tank. Being equipped to carry the extra fuel, the new aircraft were able to provide effective escort for the big daylight raids over London in September 1940. 'Red 2' (no. 2058), depicted here, was being flown by Unteroffizier Klick of 3./LG 2 when it was shot down by RAF fighters in the famous raids on London on 15 September.

Messerschmitt Bf 109 in Action



The Bf 109F-2 mounted a 15-mm Mauser cannon in the nose. This example is a tropicalized version with dust filter, serving with III/JG 27 at Qasaba during 1942.



Carrying a summer camouflage, this Bf 109G-2 of 4./JG 54 served in 1942 on the Eastern Front at Siverskaya. The yellow nose, wingtip and fuselage bands were Eastern Front theatre markings.

By the end of that first day no fewer than 1,800 Soviet aircraft had been destroyed (the Soviets themselves acknowledging a loss of 1,200), a figure that rose to over 3,000 during the next 24 hours, or roughly one-third of the total strength deployed by the V-VS on the Eastern Front.

The Jagdverband had exploited its killing ground admirably. Many pilots flew upwards of 40 combat sorties in the first week of Operation 'Barbarossa'. Germany's renowned fighter pilot, Werner Mölders who commanded JG 51, himself destroyed 33 enemy aircraft in three weeks and became the first member of the German armed forces to be awarded the Diamonds to the Knight's Cross (only to be killed in a flying accident behind the front four months later). His *Geschwader* was the first to reach the figure of 1,000 aircraft destroyed (on 30 June), and this achievement was emulated by JG 3, JG 52, JG 53, JG 54 and JG 77 in the coming months. Every one of these formations was equipped with the Bf 109 fighter.

While Bf 109s continued to dominate the German fighter inventory in the Eastern and Mediterranean theatres for the remainder of the war, the air defence of Germany itself assumed growing importance from late 1942 onwards as the American daylight heavy bomber offensive began to mount in intensity. By then a new version of the Bf 109 (and as it transpired, the most widely used) was being introduced into service. The Bf 109G, or 'Gustav', with 1100-KW (1,475-hp) high-compression DB 605 engine, was a generally beefed-up version of the 'Friedrich', featuring locally-strengthened airframe and landing gear, an armament of a faster-firing 20-mm cannon and two heavy machine-guns, and (in most instances) a pressurized cockpit. Nevertheless the 'Gustav' remained primarily a 'dogfighter' for some months, its gun armament still proving generally inadequate to knock down the big American bombers.

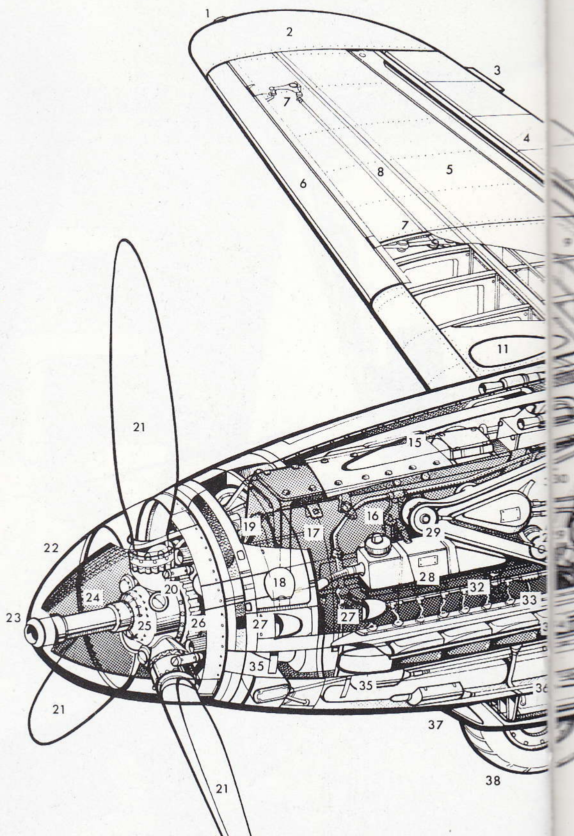
Defence of the Reich

Among the first 'Gustav'-equipped home-defence units was I/JG 1, but during the early months of 1943 this was joined by the newly-formed Jagdgeschwader 11 led by Anton Mader. Still the German single-engine fighters seemed unable to make much impression on the American Boeing B-17 formations except by employing head-on attacks, tactics that were favoured by the German *Experten* but as unnerving for the inexperienced fighter pilot as they were for the bomber crews. At that time only the single 20-mm cannon of the 'Gustav' possessed the range to outgun the Americans' 12.7-mm (0.5-in) machine-guns, and it was obvious that only when armed with longer-ranged weapons would German fighters be able to destroy the bombers.

In the meantime a young pilot, Heinz Knocke of 5./JG 1, hit on the idea of dropping time-fused 250-kg (551-lb) bombs into the American bomber formations, a tactic which was tried with limited success. However, by now the USAAF was increasingly sending Republic P-47 escort fighters with the bombers and, weighed down with a bomb, the 'Gustav' was at an immediate

Messerschmitt Bf 109G-14/U4 cutaway drawing key

1 Starboard navigation light
2 Starboard wingtip
3 Fixed trim tab
4 Starboard Frise-type aileron
5 Flush-riveted stressed wing-skinning
6 Handley Page leading-edge automatic slat
7 Slat control linkage
8 Slat equalizer rod
9 Aileron control linkage
20 Propeller pitch-change mechanism
21 VDM electrically-operated constant-speed propeller
22 Spinner
23 Engine-mounted cannon muzzle
24 Blast tube
25 Propeller hub
26 Spinner back plate
27 Auxiliary cooling intakes
28 Cooling header tank



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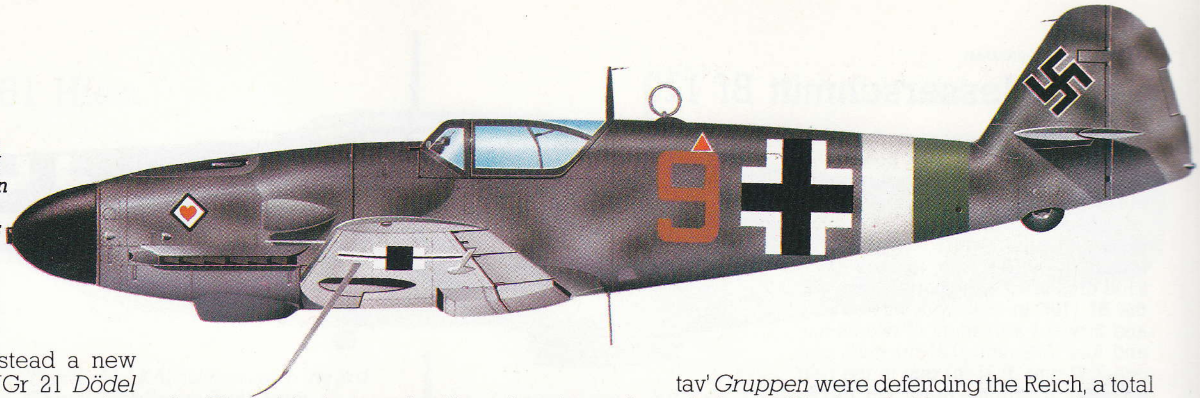
10 Fabric-covered flap section
11 Wheel fairing
12 Port fuselage machine-gun ammunition-feed fairing
13 Port Rheinmetall Borsig 13-mm MG 131 machine-gun
14 Engine accessories
15 Starboard machine-gun trough
16 Daimler Benz DB 605AM 12-cylinder inverted-vee liquid-cooled engine
17 Detachable cowling panel
18 Oil filter access
19 Oil tank
29 Anti-vibration rubber engine-mounting pads
30 Elektron forged engine bearer
31 Engine bearer support strut attachment
32 Plug leads
33 Exhaust manifold fairing strip
34 Ejector exhausts
35 Cowling fasteners

Seen on the Eastern Front, this Bf 109G-6/R6 belongs to the Slovakian 13. stiháchi letká and carries the Slovakian tricolor on the spinner. The R6 field modification added two 20-mm MG 151 cannon under the wings.



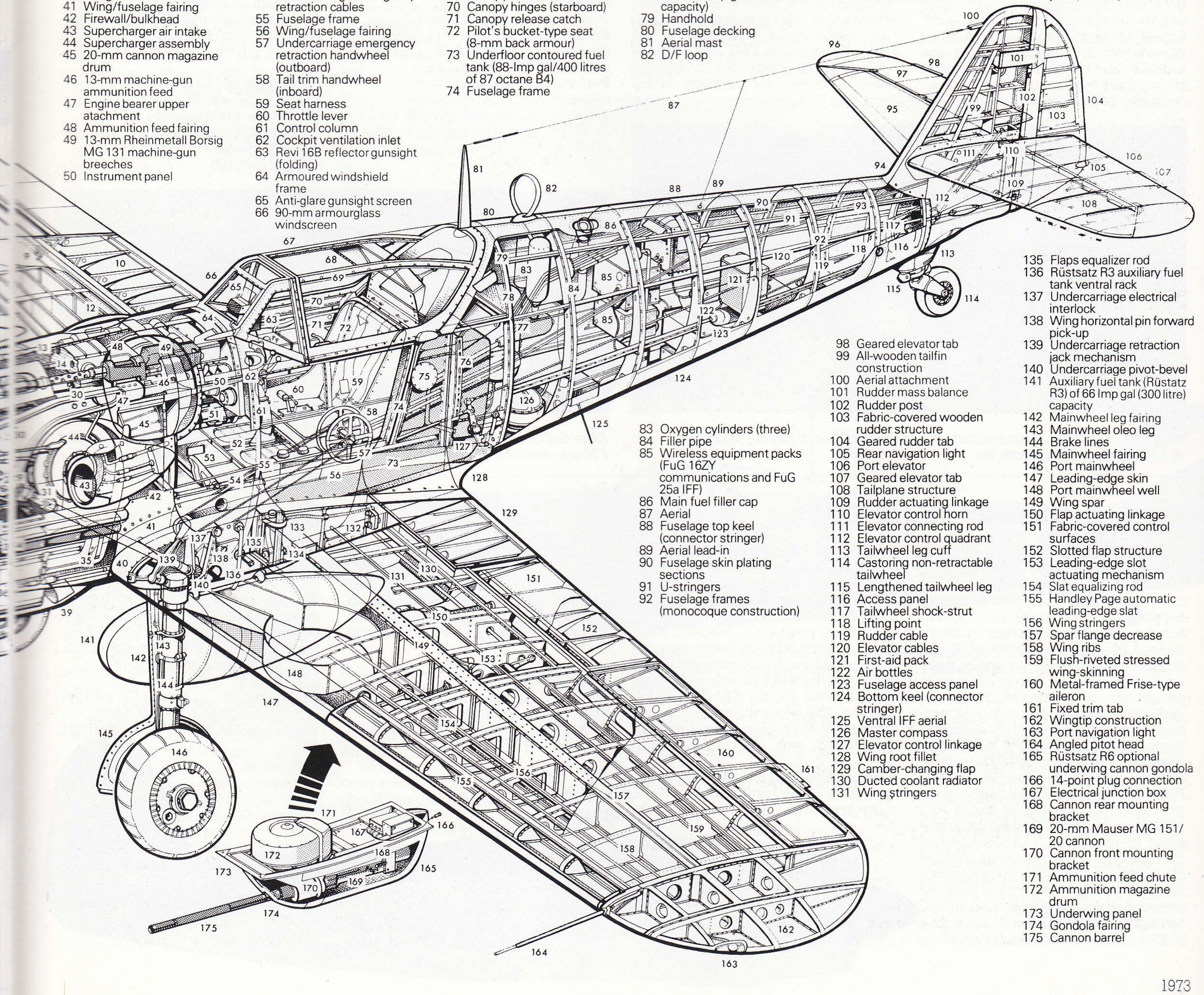
The ultimate combat variant was the Bf 109K, here exemplified by a K-4 of II/JG 77 based at Bönninghardt late in 1944. The 'K' series embodied several aerodynamic improvements over the G-10, including rudder tab and raised cowling line.

disadvantage in a dogfight. Instead a new weapon was introduced, the WGr 21 *Ködel* 21-cm (8.27-in) rocket, a single missile being launched from a tube bolted under each wing. When used by large formations of 'Gustavs' this weapon proved relatively effective, though haphazard, but even after discharge of the rockets the German fighter was still badly handicapped in air combat by the drag of the tubes.

When sufficient quantities became available 30-mm MK 108 cannon were eventually fitted to the 'Gustav', being attached in underwing pods as the Bf 109's wing was unable to accommodate the gun internally

During the summer of 1943, as the British and American bomber offensives began to take a devastating toll of German cities, and production of the 'Gustav' was quickly stepped up, most of the *Jagdgeschwader* introduced a fourth *Gruppe*, thereby increasing their strength to almost 150 fighters. By then 16 'Gustav' *Gruppen* were defending the Reich, a total of about 550 aircraft. Yet sheer numbers of defending fighters, contrary to circumstances that had existed during the Battle of Britain, were no criterion in the great air battles over Germany, for the 'Gustav' constituted a frustrating compromise: unable to knock down the bombers except when armed with heavy guns and/or rockets, and unable to match the North American P-51 and P-47 fighters when burdened with this armament.

36 Oil cooler
37 Oil cooler intake
38 Starboard mainwheel
39 Oil cooler outlet flap
40 Wing root fillet
41 Wing/fuselage fairing
42 Firewall/bulkhead
43 Supercharger air intake
44 Supercharger assembly
45 20-mm cannon magazine drum
46 13-mm machine-gun ammunition feed
47 Engine bearer upper atachment
48 Ammunition feed fairing
49 13-mm Rheinmetall Borsig MG 131 machine-gun breeches
50 Instrument panel
51 20-mm Mauser MG 151/20 cannon breech
52 Heelrests
53 Rudder pedals
54 Undercarriage emergency retraction cables
55 Fuselage frame
56 Wing/fuselage fairing
57 Undercarriage emergency retraction handwheel (outboard)
58 Tail trim handwheel (inboard)
59 Seat harness
60 Throttle lever
61 Control column
62 Cockpit ventilation inlet
63 Revi 16B reflector gunsight (folding)
64 Armoured windshield frame
65 Anti-glare gunsight screen
66 90-mm armourglass windscreen
67 'Galland'-type clear-vision hinged canopy
68 Framed armourglass head/ back panel
69 Canopy contoured frame
70 Canopy hinges (starboard)
71 Canopy release catch
72 Pilot's bucket-type seat (8-mm back armour)
73 Underfloor contoured fuel tank (88-Imp gal/400 litres of 87 octane B4)
74 Fuselage frame
75 Circular access panel
76 Tail trimming cable conduit
77 Wireless leads
78 MW 50 (methanol/water) tank (25 Imp gal/114 litres capacity)
79 Handhold
80 Fuselage decking
81 Aerial mast
82 D/F loop
83 Oxygen cylinders (three)
84 Filler pipe
85 Wireless equipment packs (FuG 16ZY communications and FuG 25a IFF)
86 Main fuel filler cap
87 Aerial
88 Fuselage top keel (connector stringer)
89 Aerial lead-in
90 Fuselage skin plating sections
91 U-stringers
92 Fuselage frames (monocoque construction)
93 Tail trimming cables
94 Tailfin root fairing
95 Starboard fixed tailplane
96 Elevator balance
97 Starboard elevator
98 Geared elevator tab
99 All-wooden tailfin construction
100 Aerial attachment
101 Rudder mass balance
102 Rudder post
103 Fabric-covered wooden rudder structure
104 Geared rudder tab
105 Rear navigation light
106 Port elevator
107 Geared elevator tab
108 Tailplane structure
109 Rudder actuating linkage
110 Elevator control horn
111 Elevator connecting rod
112 Elevator control quadrant
113 Tailwheel leg cuff
114 Castoring non-retractable tailwheel
115 Lengthened tailwheel leg
116 Access panel
117 Tailwheel shock-strut
118 Lifting point
119 Rudder cable
120 Elevator cables
121 First-aid pack
122 Air bottles
123 Fuselage access panel
124 Bottom keel (connector stringer)
125 Ventral IFF aerial
126 Master compass
127 Elevator control linkage
128 Wing root fillet
129 Camber-changing flap
130 Ducted coolant radiator
131 Wing stringers
132 Wing rear pick-up point
133 Spar/fuselage upper pin joint (horizontal)
134 Spar/fuselage lower pin joint (vertical)
135 Flaps equalizer rod
136 Rüstsatz R3 auxiliary fuel tank ventral rack
137 Undercarriage electrical interlock
138 Wing horizontal pin forward pick-up
139 Undercarriage retraction jack mechanism
140 Undercarriage pivot-bevel
141 Auxiliary fuel tank (Rüstatz R3) of 66 Imp gal (300 litre) capacity
142 Mainwheel leg fairing
143 Mainwheel oleo leg
144 Brake lines
145 Mainwheel fairing
146 Port mainwheel
147 Leading-edge skin
148 Port mainwheel well
149 Wing spar
150 Flap actuating linkage
151 Fabric-covered control surfaces
152 Slotted flap structure
153 Leading-edge slot actuating mechanism
154 Slat equalizing rod
155 Handley Page automatic leading-edge slat
156 Wing stringers
157 Spar flange decrease
158 Wing ribs
159 Flush-riveted stressed wing-skinning
160 Metal-framed Frise-type aileron
161 Fixed trim tab
162 Wingtip construction
163 Port navigation light
164 Angled pitot head
165 Rüstsatz R6 optional underwing cannon gondola
166 14-point plug connection
167 Electrical junction box
168 Cannon rear mounting bracket
169 20-mm Mauser MG 151/ 20 cannon
170 Cannon front mounting bracket
171 Ammunition feed chute
172 Ammunition magazine drum
173 Underwing panel
174 Gondola fairing
175 Cannon barrel



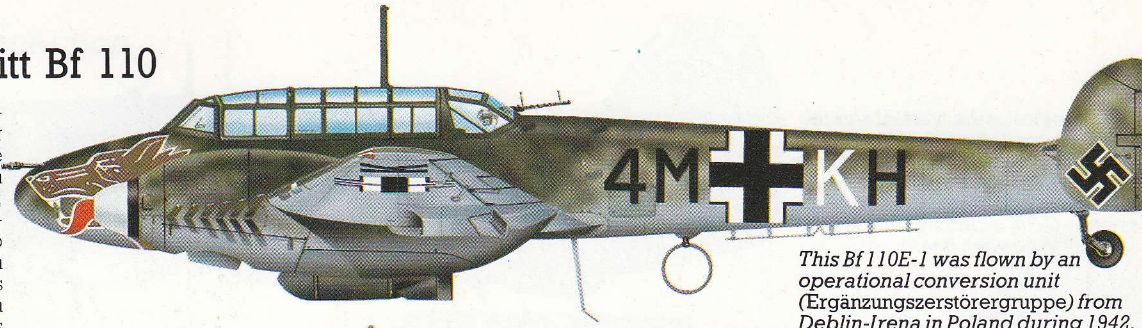
GERMANY

Messerschmitt Bf 110

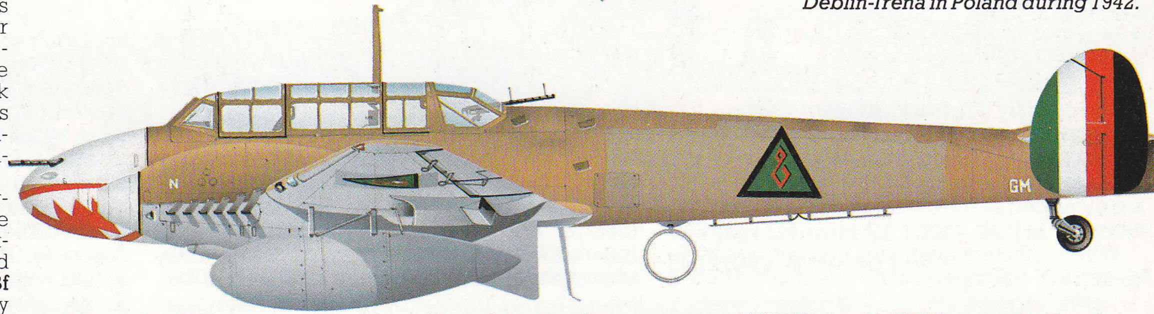
Germany's first essay in the twin-engined two-seat 'heavy fighter' (or *Zerstörer*, destroyer) category was the **Messerschmitt Bf 110**, conceived in 1934 and first flown on 12 May 1936; pre-production Bf 110A-0 fighters followed in 1937-8 with Junkers Jumo 210B engines. Production started with the **Bf 110B** in 1938 with Jumo 210Gs and forward armament of two 20-mm and four 7.92-mm (0.31-in) guns plus one 7.92-mm (0.31-in) gun in the rear cockpit. Daimler-Benz DB 601A-powered **Bf 110C** aircraft joined the Luftwaffe in 1939 in time for the attack on Poland, and were employed as fighters and fighter-bombers throughout 1940; the **Bf 110C-5** was a reconnaissance version.

The long-range **Bf 110D** entered service in 1940, and sub-variants were the first Bf 110s to be employed as night-fighters; there were also tropicalized and fighter-bomber versions. The **Bf 110E** fighter-bomber was powered by DB 601Ns and the **Bf 110F** by DB 601Es.

Despite its high top speed, the Bf 110 was quickly shown to be no match for opposing single-engine fighters, and from 1941 development was confined mainly to ground-attack and night-fighter versions. The **Bf 110F-4** introduced two 30-mm guns under the fuselage, and the **Bf 110F-4/U1** featured twin upward-firing 20-mm guns (*schräge Musik* installation). The **Bf 110G** with DB 605Bs was produced in *Zerstörer*, fighter-bomber, reconnaissance and night-fighter versions, and sub-variants introduced the 37-mm gun under the fuselage. Radar-equipped Bf 110Gs formed the principal night-fighter equipment of the Luftwaffe between 1943 and 1945, as well as participating in the daylight air defence battles over Germany during this period.



This Bf 110E-1 was flown by an operational conversion unit (Ergänzungszerstörergruppe) from Deblin-Irena in Poland during 1942.



Flown by Luftwaffe crews, several Bf 110D-3s of 4./ZG 76 supported Iraqi insurgent forces in May 1941. Tanks were carried for extra range.

Specification

Messerschmitt Bf 110C-4

Type: two-seat heavy fighter

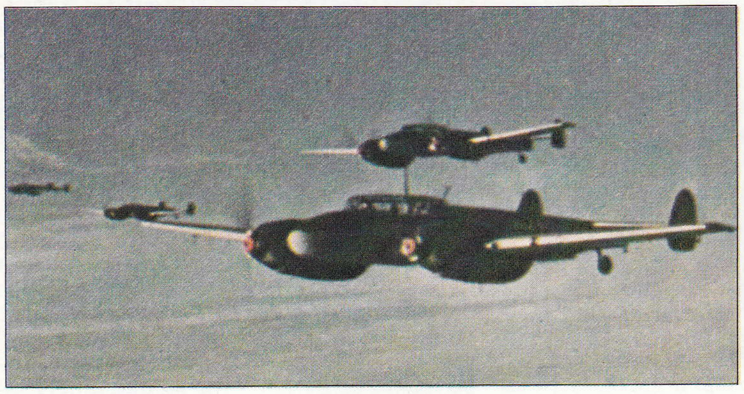
Powerplant: two 820-kW (1,100-hp) Daimler-Benz DB 601A 12-cylinder inverted-Vee piston engines

Performance: maximum speed 560 km/h (348 mph) at 7000 m (22,966 ft); initial climb rate 660 m (2,165 ft) per minute; service ceiling 10000 m (32,808 ft); normal range 775 km (482 miles)

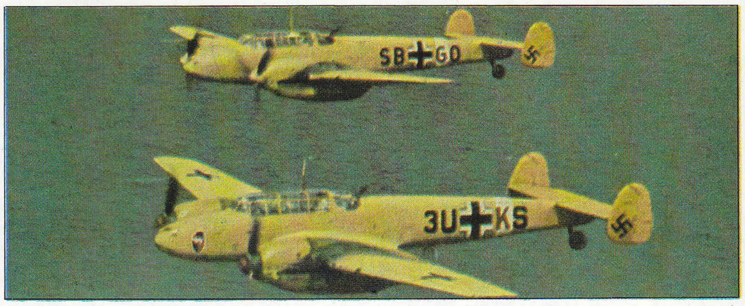
Weights: empty 5200 kg (11,464 lb); maximum take-off 6750 kg (14,881 lb)

Dimensions: span 16.27 m (53 ft 4.6 in); length 12.65 m (41 ft 6 in); height 3.50 m (11 ft 5.8 in); wing area 38.40 m^2 (413.3 sq ft)

Armament: two 20-mm MG FF cannon and four 7.92-mm (0.31-in) MG 17 guns in the nose, firing forward, and one 7.92-mm (0.31-in) MG 15 machine-gun on trainable mounting in the rear cockpit firing aft



Bf 110s were at their best operating at high altitude away from the restrictions of having to escort bombers.



After the debacle over Britain, the Bf 110 was switched to other theatres such as the Mediterranean, where its heavy armament proved useful.

JAPAN

Kawanishi N1K1 Shiden

In 1941 Kawanishi was still engaged in design of an attractive float-equipped fighter, the **Kawanishi N1K1**, intended as a naval fighter to support an island-hopping conquest in the Pacific without dependence on carriers or shore bases; in due course 98 of these fighters (Allied reporting name **'Rex'**) were produced. However, while their design was still in progress Kawanishi undertook a wheel-landing gear version, designated the **N1K1-J Shiden** (violet lightning). The prototype of the new fighter was flown on 27 December 1942 powered by the new 18-cylinder Nakajima Homare radial. Production got under way in 1943 of the N1K1-J with Homare 21 radial and an armament of two 7.7-mm (0.303-in) nose guns and four 20-mm wing cannon (two of which were carried in underwing fairings). Despite being plagued by constant engine troubles and an inherently weak landing gear, the Shiden was an excellent aircraft in combat, proving an equal match for the Grumman F6F Hellcat; given the reporting name **'George'** by the Allies, it was widely considered to be one of Japan's best wartime fighters. Three other main production versions were produced: the **N1K1-Ja** with nose guns deleted and all cannon mounted inside the wings; the **N1K1-Jb** with underwing racks for two 250-kg (551-lb) bombs; and the **N1K1-Jc** with racks for four 250-kg (551-lb) bombs. A new version, the **N1K2-J**, with improved landing gear, redesigned airframe structure and cleaner engine cowling, appeared during the last year of the war and proved even better than the N1K1; an instance occurred when a single Japanese pilot, Warrant Officer Kinsuke Muto, fought off 12 Hellcats, shooting down four. A total of 1,435 N1K Shiden landplane fighters was produced.

Specification

Kawanishi N1K1-J

Type: single-seat fighter

Powerplant: one 1484-kW (1,990-hp) Nakajima NK9H Homare 21 radial piston engine

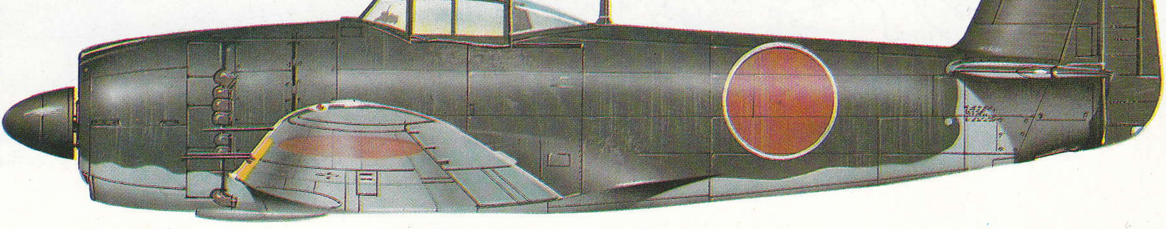
Performance: maximum speed 584 km/h (363 mph) at 5900 m (19,357 ft); climb to 6000 m (19,685 ft) in 7.8 minutes; service ceiling 12500 m (41,010 ft); range 1432 km (890 miles)

Weights: empty 2897 kg (6,387 lb); maximum take-off 4321 kg (9,526 lb)

Dimensions: span 12.00 m (39 ft 4.4 in); length 8.89 m (29 ft 2 in); height 4.06 m (13 ft 3.8 in); wing area 23.50 m^2 (252.95 sq ft)

Armament: two 7.7-mm (0.303-in) Type 97 machine-guns in nose and four wing-mounted 20-mm Type 99 cannon

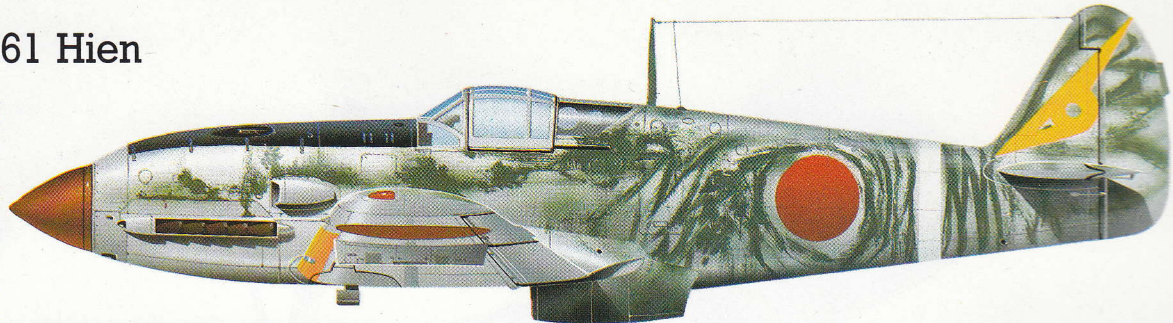
Kawanishi N1K2-J Shiden of the 343rd Kokutai. The type gave a good account of itself despite niggling early problems.



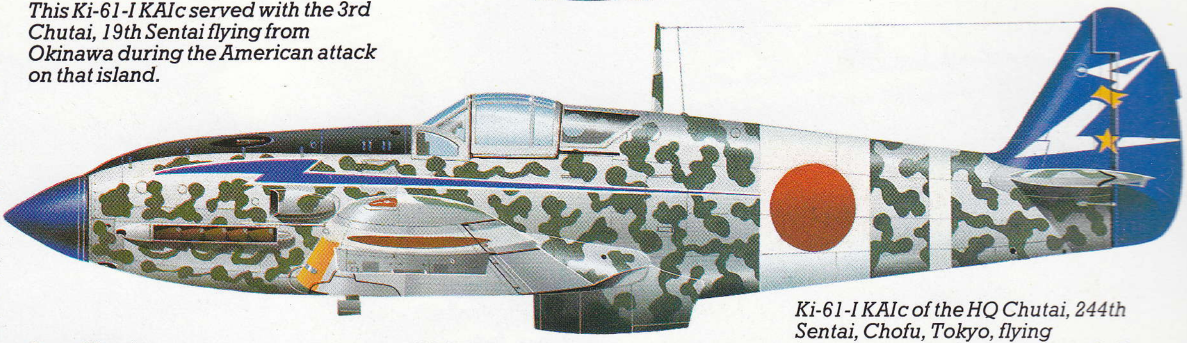
JAPAN

Kawasaki Ki-61 Hien

Sometimes described as a cross between a Messerschmitt Bf 109 and a North American P-51 Mustang, the **Kawasaki Ki-61** certainly had the distinctive nose shape associated with an inverted V-12 inline engine, the Kawasaki Ha-40 being in effect a Daimler-Benz DB 601A built under licence. The Ki-61's designers, Takeo Doi and Shin Owada, had moreover worked under the German Richard Vogt. In December 1940 they were instructed to go ahead with the Ki-61, and one year later the prototype was flown. The first production **Ki-61-I** fighters were deployed operationally in April 1943 when the 68th and 78th Sentais arrived in New Guinea. Named **Hien** (swallow) in service (and codenamed **'Tony'** by the Allies), the new aircraft proved popular with its pilots, being unusually well-armed and armoured, and the type was at least a match for opposing American fighters. Its armament (of four 12.7-mm/0.5-in machine-guns) proved inadequate to knock down enemy bombers, however, and the **Ki-61-I KAIc** was introduced with a pair of 20-mm cannon in the nose, these being replaced in a small number of **Ki-61-I KAId** fighters by two 30-mm cannon. The Ki-61-I and Ki-61-I KAI remained in production until 1945, but in 1944 they were joined in service by the **Ki-61-II** with more powerful Kawasaki Ha-140 engine (producing 1119-kW/1,500-hp); with a top speed of 610 km/h (379 mph) this would have been an excellent fighter but for constant engine problems; yet when fully serviceable the Ki-61-II was one of the few Japanese fighters fully able to combat the Boeing B-29 at its normal operating altitude, particularly when armed with four 20-mm cannon. Excluding prototypes and development aircraft, production totalled 1,380 Ki-61-Is, 1,274 Ki-61-I KAIs and 374 Ki-61-IIs.



This Ki-61-I KAIc served with the 3rd Chutai, 19th Sentai flying from Okinawa during the American attack on that island.



Ki-61-I KAIc of the HQ Chutai, 244th Sentai, Chofu, Tokyo, flying interception sorties against the B-29.

Specification

Kawasaki Ki-61-I KAIc

Type: single-seat fighter

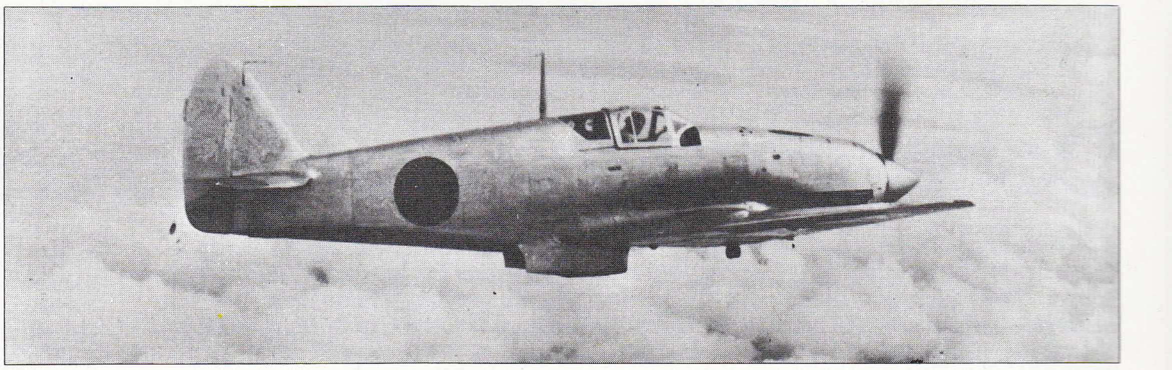
Powerplant: one 880-kW (1,180-hp) Kawasaki Ha-40 V-12 piston engine

Performance: maximum speed 590 km/h (367 mph) at 4260 m (13,976 ft); climb to 5000 m (16,404 ft) in 7.0 minutes; service ceiling 10000 m (32,808 ft); range 1800 km (1,118 miles)

Weights: empty 2630 kg (5,798 lb); normal loaded 3470 kg (7,650 lb)

Dimensions: span 12.00 m (39 ft 4.4 in); length 8.94 m (29 ft 4 in); height 3.70 m (12 ft 1.7 in); wing area 20.00 m^2 (215.3 sq ft)

Armament: two 20-mm Ho-5 cannon in nose and two 12.7-mm (0.5-in) Type 1 machine-guns in wings



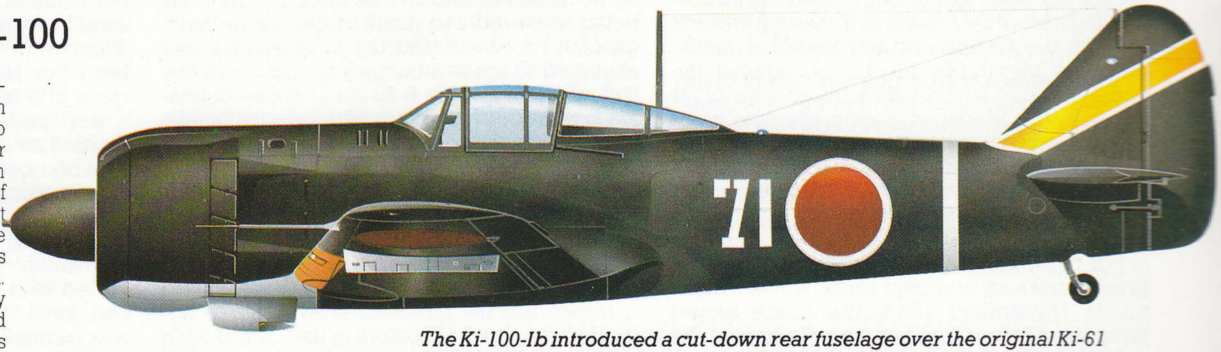
The Ki-61 was one of few Japanese fighters that could really take on the B-29s at their operating altitude.

JAPAN

Kawasaki Ki-100

The Kawasaki Ki-61-II with the company's Ha-140 engine was seen as an interim high-altitude interceptor to tackle the USAF's Boeing B-29s at their cruising altitude of some 9144 m (30,000 ft). However, development of the Ha-140 as a reliable powerplant was terminated finally when the Akashi factory where the engine was built was destroyed during an air raid. With the requirement becoming daily more urgent, Kawasaki was instructed to convert the 275 Ki-61-II airframes gathering dust in the Kagamigahara factory with alternative powerplant. No other similar engine was available and adaptation of the slender fuselage of the Ki-61 to allow installation of a large-diameter radial engine at first appeared impractical. However, Kawasaki's design team converted three airframes to serve as prototypes, installing a Mitsubishi Ha-112-II engine which had the same power output as the unreliable Ha-140. When the first of these was flown, on 1 February 1945, Kawasaki discovered that it had a first-class fighter, one that some commentators have described as Japan's premier fighter aircraft of the Pacific war. By the end of May 1945 all of the remaining 272 Ki-61 airframes had been converted to the new configuration, entering service as the Army Type 5 Fighter Model 1A, which was identified by the company as the **Kawasaki Ki-100-Ia**.

With the Ki-100 proving such a success, it was decided to initiate production of this aircraft, the resulting **Ki-100-Ib** differing only by having the cut-down rear fuselage and all-round-view canopy that had been designed for the proposed Ki-61-III. A total of 99 of this version was built before production was brought to an end by the growing weight of USAAF air attacks. A more effective version had been planned, to be powered by the Mitsubishi Ha-112-IIru engine which incorporated a turbocharger to improve high-altitude performance, but only three of these **Ki-100-II** prototypes had been built and flown by the end of the war.



The Ki-100-Ib introduced a cut-down rear fuselage over the original Ki-61 shape, which improved pilot vision. This aircraft is from the 3rd Chutai, 59th Sentai.

Specification

Kawasaki Ki-100-Ia/b

Type: single-seat interceptor fighter

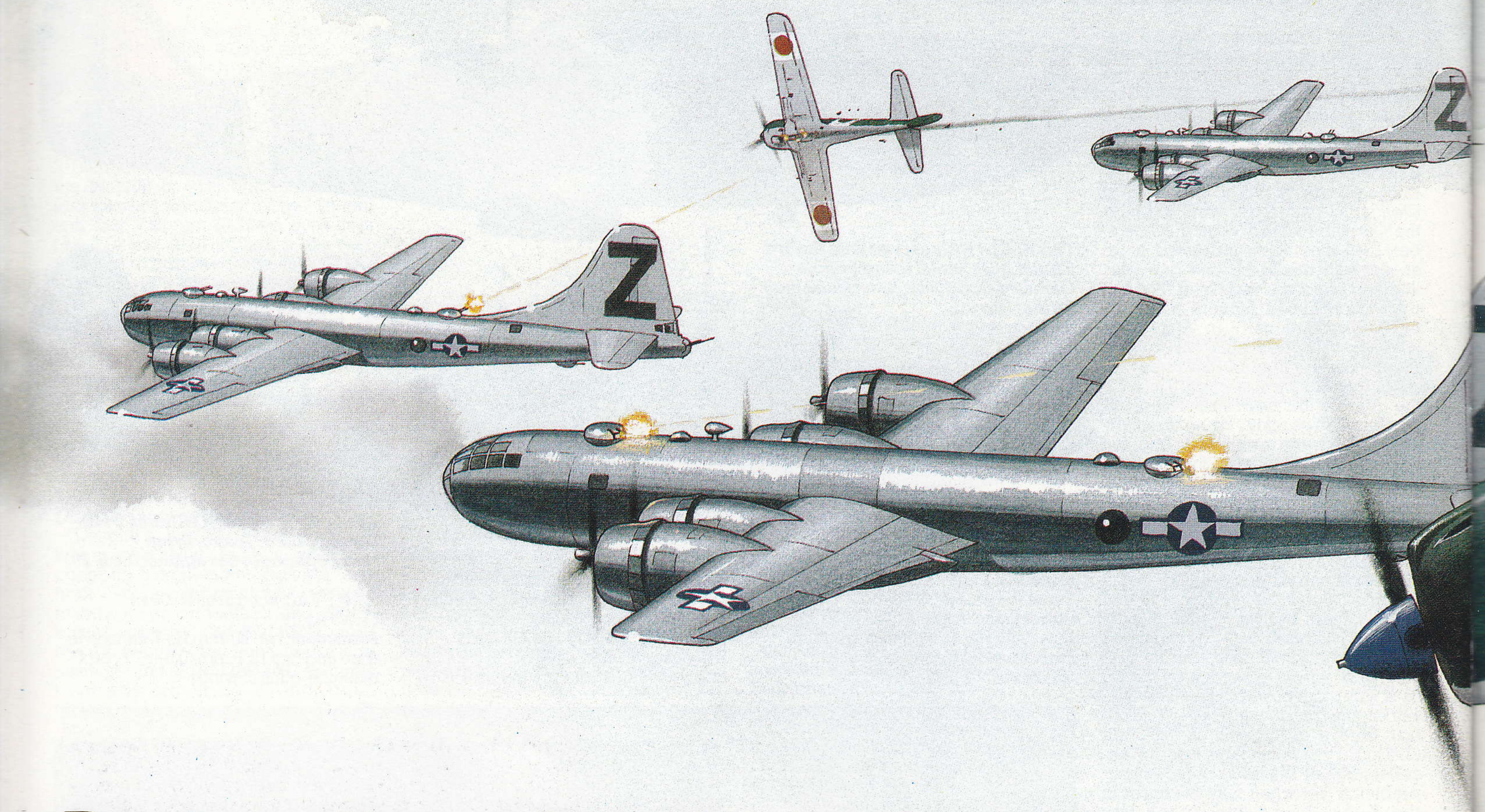
Powerplant: one 1119-kW (1,500-hp) Mitsubishi Ha-112-II 14-cylinder radial piston engine

Performance: maximum speed 590 km/h (367 mph) at 10000 m (32,810 ft); climb to 10000 m (32,810 ft) in 20 minutes; cruising speed 350 km/h (217 mph); service ceiling 10670 m (35,007 ft); range 2000 km (1,243 miles)

Weights: 2700 kg (5,952 lb); maximum take-off 3670 kg (8,091 lb)

Dimensions: span 12.00 m (39 ft 4.4 in); length 8.80 m (28 ft 10.5 in); height 3.75 m (12 ft 3.6 in); wing area 20.00 m^2 (215.3 sq ft)

Armament: two fuselage-mounted 12.7-mm (0.5-in) Ho-103 (Type 1) machine-guns and two wing-mounted 20-mm Ho-5 cannon, plus two drop-tanks or two 250-kg (551-lb) bombs



Defending the Homeland

The defence of mainland Japan had enjoyed only low priority, both when Japan's forces rampaged across the Pacific and, later, when they began to defend their new empire against the Allied counterattack. But by late 1944 mighty fleets of B-29 Superfortresses were preparing to lay waste the home islands, and the race began to improvise a defence.

As the Japanese warlords watched the inexorable advances by American forces northwards through the Philippines and began to anticipate the inevitable retribution against the homeland that would follow the seizure of air bases in the Marianas, frantic attempts were being made to create an air-defence system capable of protecting metropolitan Japan from the might of the US air forces. When the blows fell they came with unimagined weight and devastation.

For many months before the opening of the great American bombing raids, which started on 24 November 1944, the home-based Japanese fighter force had been bottom of the priority list, the 17th, 18th and 19th Hikodans being still largely equipped with 1942-vintage Nakajima Ki-43 'Oscar' fighters (top speed 530 km/h; 329 mph and armed with two 12.7-mm/0.5-in machine-guns). At that time only 13 per cent of Japan's total fighter strength was based at home. Radar equipment ringing the Japanese islands was rudimentary in the extreme, without height definition and capable of 'seeing' no more than 65 km (40 miles); considerable reliance was still placed upon sighting reports radioed from picket boats, whose performance would be unreliable to say the least when the huge B-29 formations approached at 9145 m (30,000 ft).

Nevertheless the early American raids were by no means as effective as planned, the raids being scattered as a result of long-range navigational problems, and the Japanese fighters managed to score a number of successes despite the fact that the B-29 could almost outdistance a Ki-43, even when carrying a full bombload. However, the bomber crews' proficiency quickly improved and devastating daylight attacks were soon made by increasing numbers of B-29s upon Akashi, Kobe, Musashino and Nagoya.

New equipment

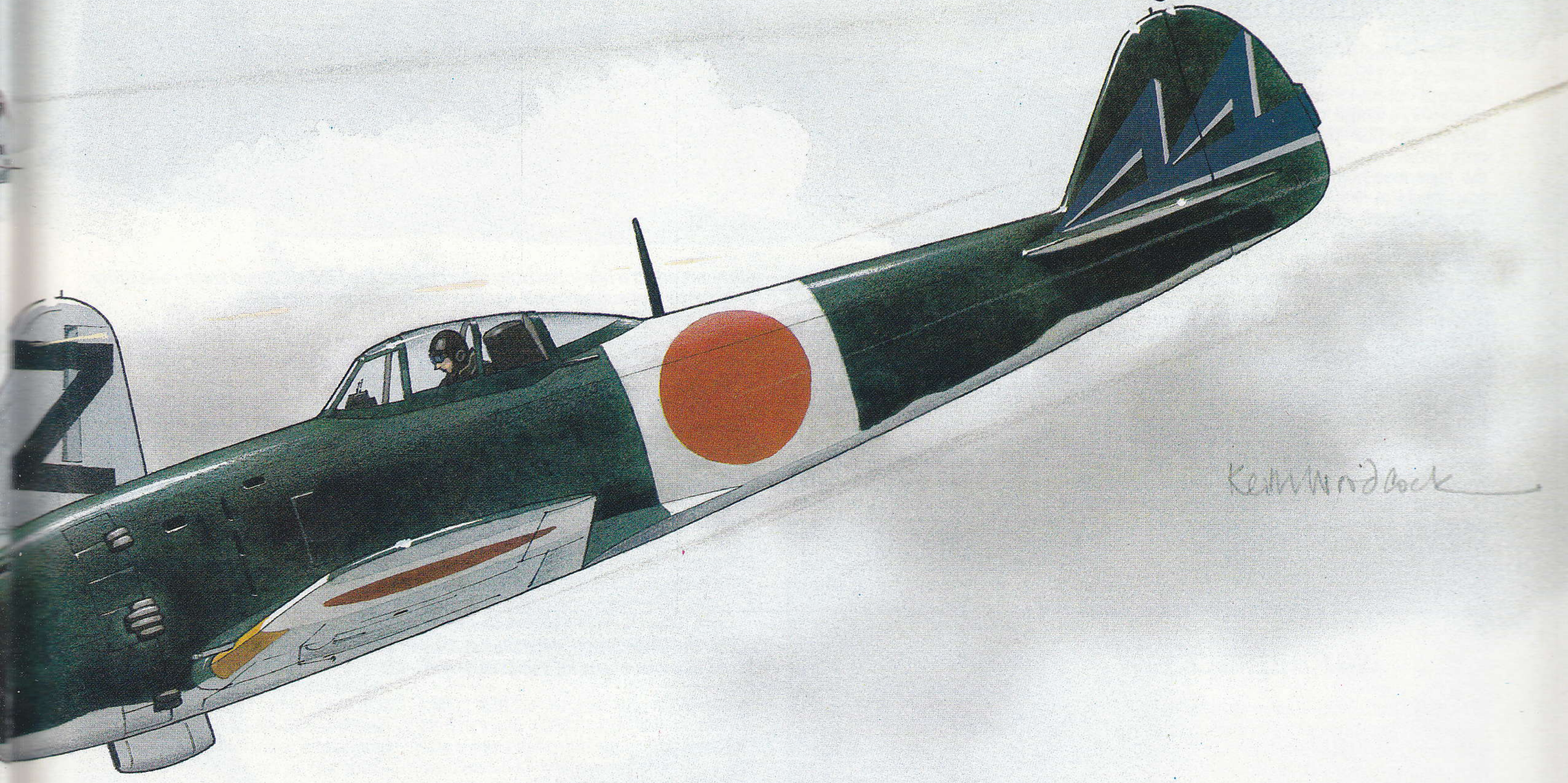
Meanwhile the Japanese army air force upgraded the three *Hikodans* in the 1st Kokugan to divisional status, and new equipment was rushed out from the factories. The Nakajima Ki-44-II 'Tojo' (top speed 604 km/h; 375 mph and armed with four 20-mm cannon) equipped several *Sentais* including the 47th, one of whose *Chutais* used the aircraft for suicidal ramming attacks against B-29s in defence of Tokyo.

Surprisingly, both the Ki-44 and the much respected Nakajima Ki-84 'Frank' (top speed 631 km/h; 392 mph and armed with four 20-mm cannon) were flown more effectively by the relatively inexperienced Japanese pilots than those who had been flying the earlier generations of much lighter fighters for many months: the older pilots instinctively attempted manoeuvres that caused the new fighters with higher wing loadings to flick or stall and spin. Certainly the introduction of 20-, 37- and 40-mm cannon did much to offset the earlier fighters' inability to carry out normal quarter attacks on the B-29s (owing to inadequate speed margin), but when in 1945 the Americans were able to send powerful formations of long-range North American P-51D escort fighters with the bombers the Japanese interceptors were once more at a tactical disadvantage.

Recognizing that the Japanese army air force by itself would be unable to stem the big American bomber formations, the Japanese navy air force participated in the defence of metropolitan Japan from the outset, contributing some of the best fighters and pilots. Best of all was the Kawanishi N1K2 (594 km/h; 369 mph and armed with four 20-mm cannon and two 12.7-mm guns), but deliveries of this aircraft, which was perfectly capable of matching any of the American naval fighters that started operating over Japan in 1945, were badly disrupted by the B-29 attacks against its factories.

When the Americans switched to night attacks by the B-29s on 9/10 March 1945 the Japanese were even more helpless in defence, once more the rudimentary state of their radar technology severely limiting the performance of the defending night-fighters, such as they were. Far too late had the Japanese high command recognized the possibility of a threat to the homeland.

With such poor ground radar at their disposal, the Japanese tended to emulate the German *wilde Sau* tactics, using freelancing day fighters against the night raiders, which were



The air battles between the daily B-29 formations and the desperate fighter pilots defending the Japanese homeland were bitter, bloody affairs. Among the most effective of the fighters was the Nakajima Ki-84, here represented by an aircraft of the 1st Chutai, 47th Sentai. Many bombers were downed, but in turn the defenders were cut to ribbons by the deadly 0.50-calibre machine-guns of the bombers and their escorting Mustangs and Thunderbolts.

frequently silhouetted against the great expanses of fire below, and the defending fighter pilots paid little heed to the flak, whose gunners in turn recognized no restriction of fire against the raiders. Much greater success attended the efforts by Japanese night intruders (usually in such aircraft as the Mitsubishi Ki-46 which, like the German night-fighters, came to be fitted with upward-firing cannon) which prowled over the B-29 bases in the Marianas; when the Americans introduced their big Northrop P-61 Black Widow night-fighters, however, the depredations of the Japanese night-fighters ended abruptly.

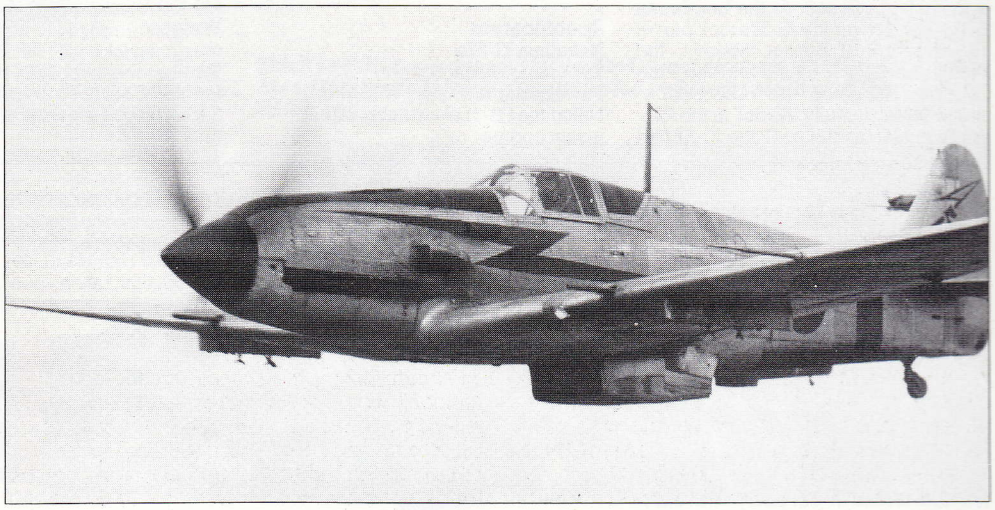
Although in the final weeks of World War II Japan was making some remarkable progress in developing effective interceptors, both as bomber-destroyers and as dogfighters capable of matching the superlative P-51D, the constant attacks on the factories of Japan (particularly those turning out aircraft engines) put paid to stemming the devastating raids. The dropping of the two atomic bombs in any case rendered their efforts superfluous.

Japanese heroes

That any individual Japanese fighter pilot should have achieved outstanding success was perhaps extraordinary having regard for the absolute American air superiority over Japan in the final nine months of the war. Yet, spurred by the ultimate motivation (defence of one's home) many such men fought with considerable skill and bravery against the great bomber armadas. The legendary Saburo Sakai, who had shot down the first American aircraft to fall in the Philippines on 8 December 1941 and who was appallingly wounded and lost an eye over Guadalcanal, joined in the defence of Japan and destroyed an American aircraft on the last day of the war, thereby completing a personal tally of 62 air victories. Among the most successful of the night-fighter pilots was the naval pilot Sachio Endo who, flying a Nakajima J1N 'Irving', destroyed a total of seven B-29s, but was killed in a daylight combat with American fighters. An army pilot, Captain Totaro Ito, who flew Kawasaki Ki-45s, destroyed nine of the big bombers and was one of the very small number of pilots to receive the coveted Bukosho award. Another recipient of the Bukosho was Kawasaki Ki-61 pilot Major Teruhiko Kobayishi, the army's youngest *Sentai* commander, who was shot down in his first attack on a B-29; he escaped from this ordeal without injury, and again miraculously survived after ramming another B-29 on 27 January 1945.

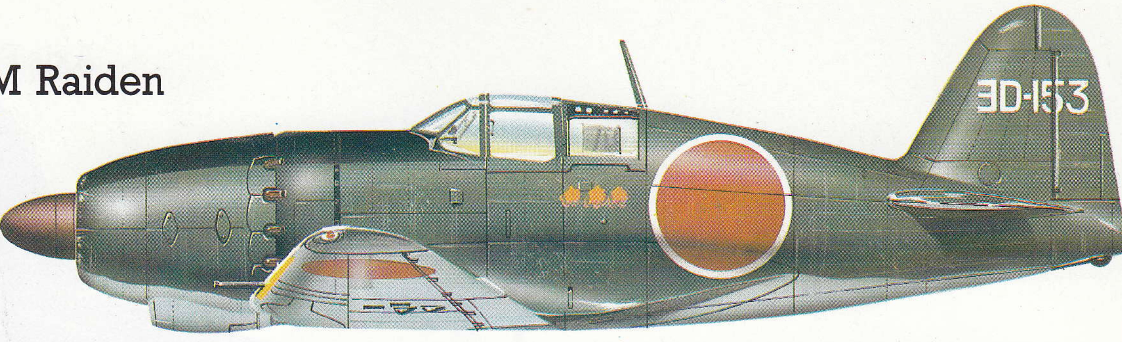
Like the Germans the Japanese were forced to embark on desperate expedients in their attempts to stem the great American bomber offensive, and had progressed a considerable distance on the road to developing jet fighters. Several examples of the navy's Mitsubishi J8M1 rocket interceptor (closely resembling the Messerschmitt Me 163 Komet) and the Nakajima Kikka twin-jet fighter (similar to the Me 262) had been completed before the end of the war, but neither reached a service unit before the two final bombs burst above the doomed cities of Hiroshima and Nagasaki.

This Ki-61 Hien bears the markings of the 244th Sentai, one of the most famous units established at Chofu in the Tokyo Prefecture for home defence in October 1944; it was commanded by Major Teruhiko Kobayishi, who personally shot down about a dozen American B-29s.



JAPAN

Mitsubishi J2M Raiden



Conceived as a fast-climbing interceptor, the J2M suffered from reliability problems but scored well against the American bombers.

Although designed to a 1939 requirement, at a time when Japanese war leaders scarcely imagined a situation requiring a home defence fighter, the **Mitsubishi J2M Raiden** (thunderbolt) only came into its own while defending the Japanese homeland against American raids in the last year of the war. The Japanese navy's emphasis upon speed and climb rate, rather than its customary demands for range and manoeuvrability, prompted the designer Jiro Hirikoshi to adopt a squat single-engine design with long-chord radial engine cowling, laminar-flow wings and high-raked, curved windscreen. First flight of the prototype **J2M1** took place on 20 March 1942, but the aircraft soon attracted criticism from navy pilots on numerous counts, not least that the view from the cockpit was inadequate. Modifications to rectify these shortcomings were delayed owing to Mitsubishi's preoccupation with the A6M. Production **J2M2** fighters left the factory slowly and entered service with the 381st Kokutai late in 1943, and were followed by the **J2M3** with a stronger wing stressed to mount four 20-mm cannon. The heavier armament now restricted the performance of the Raiden to the extent that it no longer met the original demands, and the **J2M4** was an attempt to restore the performance by including a turbocharger. The final production variant, the **J2M5** (34 built), was powered by a 1357-kW (1,820-hp) Mitsubishi Kasei 26a radial. In all, 476 J2Ms were built. In acknowledgement of the fact that J2Ms could not combat the Boeing B-29s at their operating altitudes, some J2M3s were armed with two upward-firing 20-mm cannon in addition to their wing guns. (The Allies selected the reporting name **'Jack'** for the J2M).

Specification

Mitsubishi J2M3

Type: single-seat fighter

Powerplant: one 1342-kW (1,800-hp) Mitsubishi Kasei 23a radial piston engine

Performance: maximum speed 588 km/h (365 mph) at 5300 m (17,388 ft); climb to 10000 m (32,808 ft) in 19.5 minutes; service ceiling 11700 m (38,386 ft); range 925 km (575 miles)

Weights: empty 2460 kg (5,423 lb); normal loaded 3435 kg (7,573 lb)

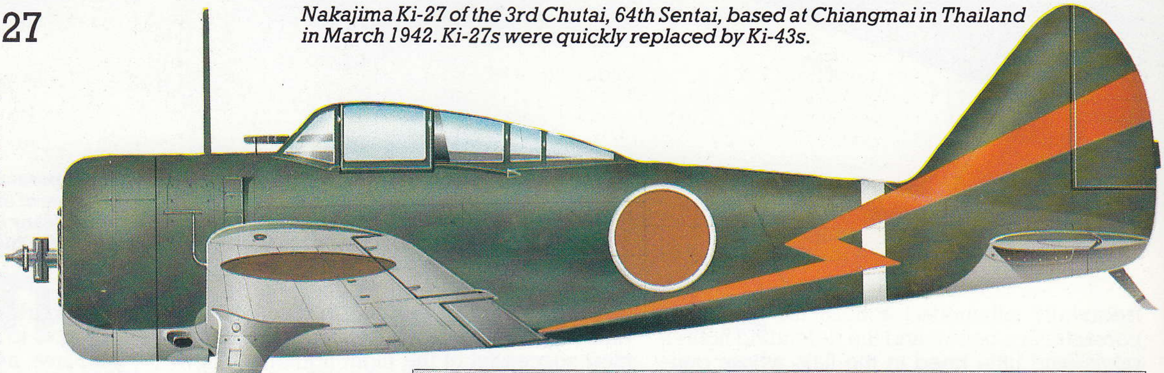
Dimensions: span 10.80 m (35 ft 5.2 in); length 9.95 m (32 ft 7.7 in); height 3.95 m (12 ft 11.5 in); wing area 20.05 m^2 (215.82 sq ft)

Armament: four wing-mounted 20-mm Type 99 cannon; some aircraft were also armed with two upward-firing 20-mm Type 99 cannon.

JAPAN

Nakajima Ki-27

Nakajima Ki-27 of the 3rd Chutai, 64th Sentai, based at Chiangmai in Thailand in March 1942. Ki-27s were quickly replaced by Ki-43s.



When in mid-1935 Kawasaki, Mitsubishi and Nakajima were instructed by the Imperial Japanese Army to build competitive prototypes of advanced fighter aircraft, Nakajima responded with a single-seat monoplane fighter derived from the company's Type P.E., which it had started to develop as a private venture. Service trials proved the Kawasaki Ki-28 to be fastest of the three contenders, but the **Nakajima Ki-27** was by far the most manoeuvrable and, on that basis, 10 pre-production examples were ordered for further service evaluation. Following further testing in late 1937 the type was ordered into production as the Army Type 97 Fighter Model A (**Nakajima Ki-27a**). Late production aircraft which introduced some refinements, including a further improved cockpit canopy, had the designation **Ki-27b**.

Nakajima could not have guessed that 3,399 aircraft would be built, by Nakajima (2,020) and Mansyu (1,379), before production came to a halt at the end of 1942, but the type's entry into service over northern China in March 1938 gave an immediate appreciation of its capability, the Ki-27s becoming masters of the airspace until confronted later by the faster Soviet Polikarpov I-16 fighters. At the beginning of the Pacific war the Ki-27s took part in the invasion of Burma, Malaya, the Netherlands East Indies and the Philippines. Allocated the Allied codename **'Nate'** (initially **'Abdul'** in the China-Burma-India theatre), the Ki-27 had considerable success against the Allies in the initial stages before more modern fighters became available. When this occurred they were transferred for air defence of the home islands, remaining deployed in this capacity until 1943 when they became used increasingly as advanced trainers. As with many Japanese aircraft, their final use was in a *kamikaze* role.

Specification

Nakajima Ki-27a

Type: single-seat fighter

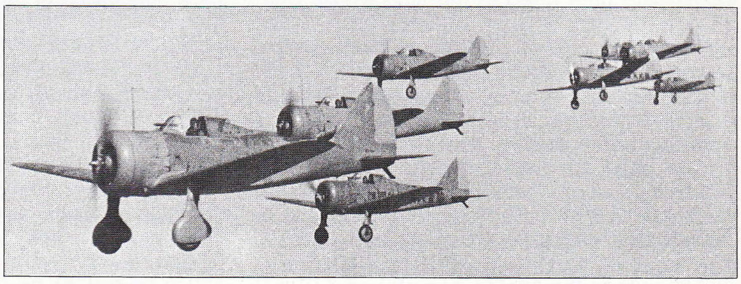
Powerplant: one 529-kW (710-hp) Nakajima Ha-1b 9-cylinder radial piston engine

Performance: maximum speed 470 km/h (292 mph) at 3500 m (11,483 ft); climb to 5000 m (16,404 ft) in 5.36 minutes; service ceiling 12250 m (40,190 ft); range 1710 km (1,063 miles)

Weights: empty 1110 kg (2,447 lb); maximum take-off 1790 kg (3,946 lb)

Dimensions: span 11.31 m (37 ft 1.3 in); length 7.53 m (24 ft 8.5 in); height 3.25 m (10 ft 8 in); wing area 18.55 m^2 (199.68 sq ft)

Armament: two forward-firing 7.7-mm (0.303-in) Type 89 machine-guns

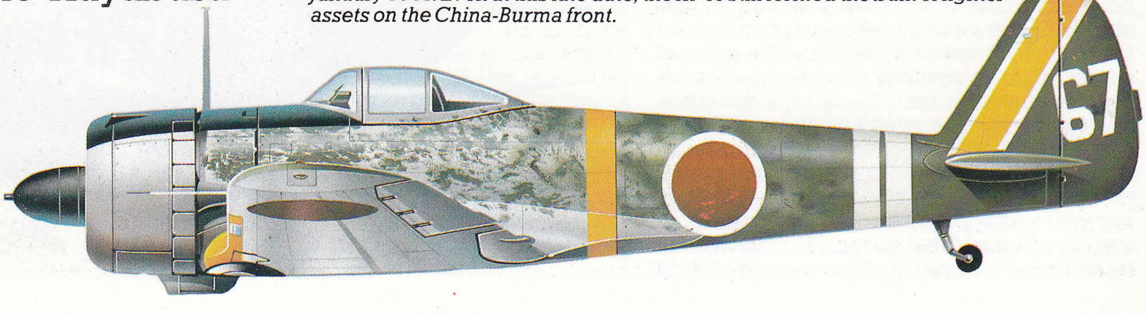


Seen in pre-war colours, this group of Ki-27s is typical of the aircraft which had performed so well against the Polikarpov fighters over China and Manchuria. The Ki-27 proved useful for training after replacement by more modern types.

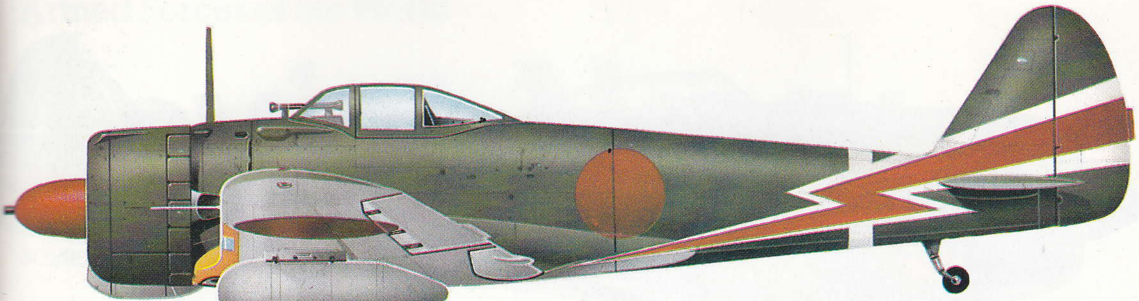
JAPAN

Nakajima Ki-43 Hayabusa

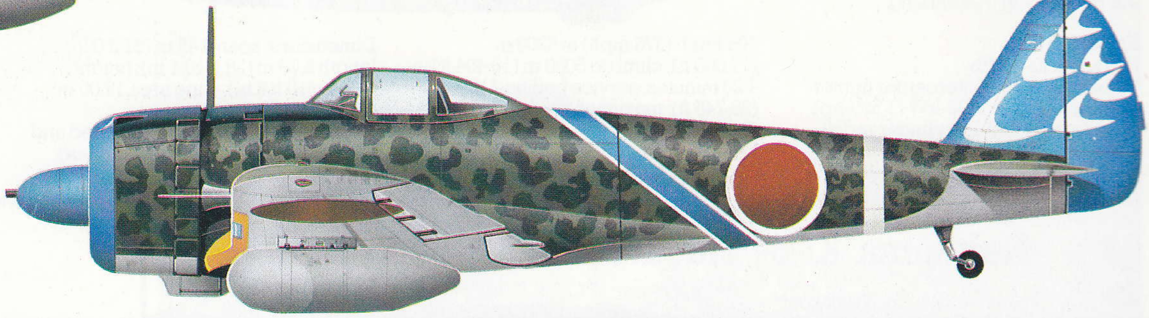
Ki-43-IIb of the 3rd Chutai, 25th Hiko Sentai, flying from Hankow, China, in January 1944. Even at this late date, the Ki-43 still formed the bulk of fighter assets on the China-Burma front.



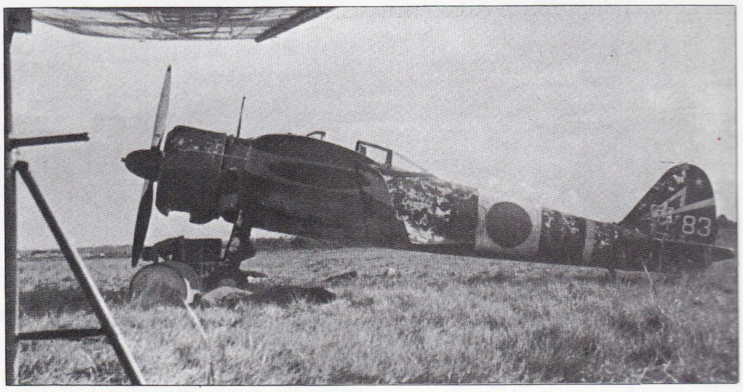
With its relatively low-powered radial engine, two-blade propeller and twin rifle-calibre machine-gun armament, the **Nakajima Ki-43 Hayabusa** (peregrine falcon) was the most dangerously underestimated Japanese fighter of the early months of the Pacific war; yet, with its outstanding manoeuvrability, it gained complete mastery over Brewster Buffaloes and Hawker Hurricanes in Burma. It was the result of a 1937 design which emerged as a light-



Nakajima Ki-43-Ic of the 1st Chutai, 50th Sentai, at Tokorozawa in June 1942. By this time, the Ki-43-Ic's shortcomings were being cruelly exposed, leading to the more powerful Ki-43-II.



This Hayabusa is a Ki-43-IIb of the Headquarters Chutai, 77th Sentai, in Burma.



Right: A Ki-43-Ib of the 47th Independent Fighter Chutai at rest on a Japanese airfield. After service in all theatres throughout the war, the Ki-43 soldiered on against the Allies, but many were expended in kamikaze attacks.

weight fighter-bomber that required no more than its 709-kW (950-hp) to meet its speed demands. In common with other Japanese fighters of the time, however, its armament was puny by RAF standards, and it possessed neither armour nor self-sealing fuel tanks. As the Allied air forces pulled themselves together after the first shock of defeat, the **Ki-43-I**'s weaknesses were discovered and increasing losses suffered, resulting in the introduction of the **Ki-43-II** (codenamed **'Oscar'** by the Allies), with pilot armour, rudimentary self-sealing fuel tanks and reflector gunsight; the engine was also changed to the 858-kW (1,150-hp) Nakajima Ha-115 radial which increased the top speed to 530 km/h (329 mph), roughly the same as that of the Hurricane Mk II. The **Ki-43-IIb** entered mass production in November 1942, first with Nakajima and six months later with Tachikawa. Final variant was the **Ki-43-III** with 917-kW (1,230-hp) engine and a top speed of 576 km/h (358 mph), but relatively few examples reached operational units. The Ki-43 was numerically the most important of all Japanese army air force aircraft, production totalling 5,886, plus 33 prototypes and trials aircraft.

Specification

Nakajima Ki-43-IIb

Type: single-seat fighter-bomber

Powerplant: one 858-kW (1,150-hp) Nakajima Ha-115 radial piston engine

Performance: maximum speed 530 km/h (329 mph) at 4000 m (13,123 ft); climb to 5000 m (16,404 ft) in 5.8 minutes; service ceiling 11200 m (36,745 ft); range 1760 km (1,094 miles)

Weights: empty 1910 kg (4,211 lb); maximum take-off 2925 kg (6,449 lb)

Dimensions: span 10.84 m (35 ft 6.8 in); length 8.92 m (29 ft 3.2 in); height 3.27 m (10 ft 8.7 in); wing area 21.40 m^2 (230.36 sq ft)

Armament: two 12.7-mm (0.5-in) Ho-103 machine-guns in wings, plus two 250-kg (551-lb) bombs carried under the wings

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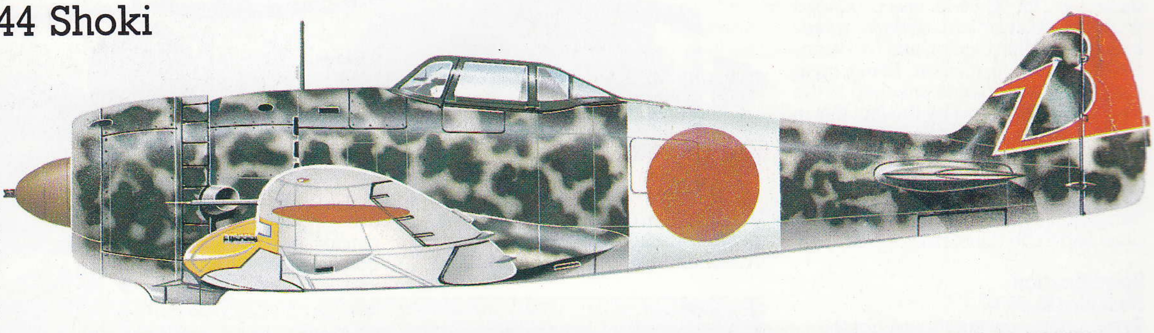
JAPAN

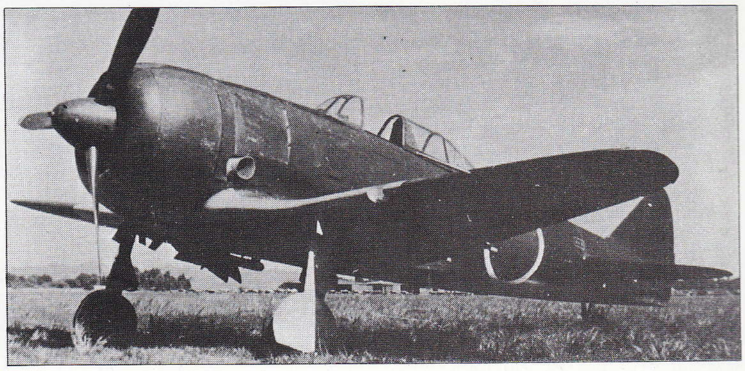
Nakajima Ki-44 Shoki

Of similar general configuration to the Ki-43, the **Nakajima Ki-44** prototypes incorporated the manoeuvring flaps that had been introduced on that aircraft, and carried an armament of two 7.7-mm (0.303-in) and two 12.7-mm (0.5-in) machine-guns. First flown in August 1940, the Ki-44 was involved in a series of comparative trials against Kawasaki's Ki-60 prototype, based on use of the Daimler-Benz DB 601 engine, and an imported Messerschmitt Bf 109E. The result of this evaluation, and extensive service trials, showed the Ki-44 to be good enough to enter production, and it was ordered under the designation Army Type 2 Single-seat Fighter Model 1A Shoki (demon), company designation **Ki-44-Ia**, which carried the same armament as the prototypes. A total of only 40 Ki-44-I aircraft was produced, including small numbers of the **Ki-44-Ib** armed with four 12.7-mm (0.5-in) machine-guns, and the similar **KI-44-Ic** with some minor refinements.

When introduced into service the high landing speeds and limited manoeuvrability of the **Shoki** made it unpopular with pilots, and very soon the **Ki-44-II** with a more powerful Nakajima Ha-109 engine was put into production. Only small numbers of the **Ki-44-IIa** were built, the variant being followed by the major production **Ki-44-IIb**. The **Ki-44-IIc** introduced much heavier armament, comprising four 20-mm cannon or, alternatively, two 12.7-mm (0.5-in) machine-guns and two 40-mm cannon, and these proved to be very effective when deployed against Allied heavy bombers attacking Japan. Final production version was the **Ki-44-III** with a 1491-kW (2,000-hp) Nakajima Ha-145 radial engine, an increase in wing area and enlarged vertical tail surfaces.



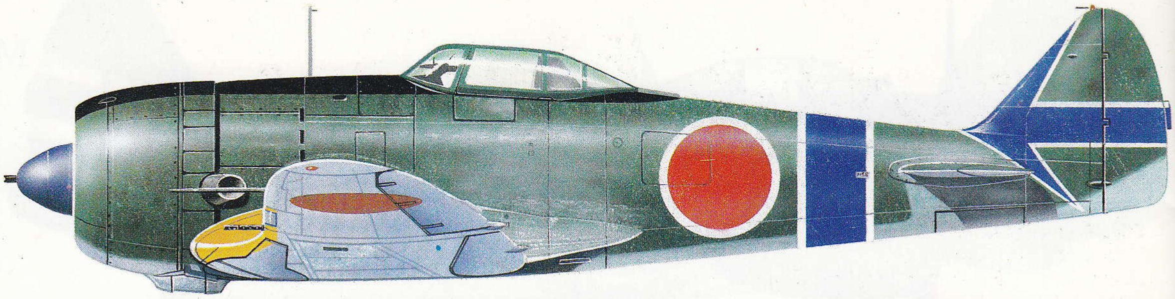
This Ki-44-IIb was employed by the 23rd Sentai for home island defence in late 1944. Most home defence aircraft carried a white square around the Hinomaru.



This photograph of a Ki-44-IIb emphasizes the powerful lines of this interceptor. When armed with cannon, the Ki-44 proved very effective against the B-29 raids, as its high rate of climb enabled it to reach the bomber streams quickly.

Nakajima Ki-44 Shoki (continued)

Nakajima had built a total of 1,225 Ki-44s of all versions, including prototypes, and these were allocated the Allied codename **'Tojo'**. They were deployed primarily in Japan, but were used also to provide an effective force of interceptors to protect vital targets, as in Sumatra where they defended the oil fields at Palembang.



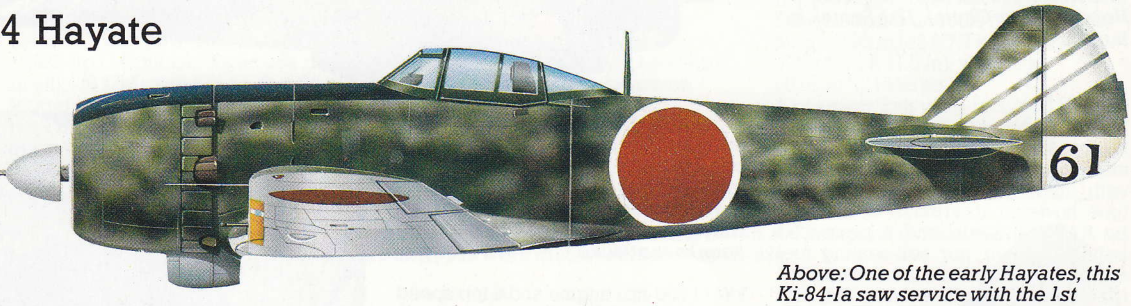
Specification
Nakajima Ki-44-IIb
Type: single-seat interceptor fighter
Powerplant: one 1133-kW (1,520-hp) Nakajima Ha-109 14-cylinder radial piston engine
Performance: maximum speed 605 km/h (376 mph) at 5200 m (17,060 ft); climb to 5000 m (16,404 ft) in 4.28 minutes; service ceiling 11200 m (36,745 ft); maximum range 1700 km (1,056 miles)
Weights: empty 2105 kg (4,641 lb); maximum take-off 2993 kg (6,598 lb)
Dimensions: span 9.45 m (31 ft 0 in); length 8.79 m (28 ft 10.1 in); height 3.25 m (10 ft 8 in); wing area 15.00 m^2 (161.46 sq ft)
Armament: two fuselage-mounted and two wing-mounted 12.7-mm (0.5-in) Ho-103 machine-guns

Lacking the agility of other Japanese fighters, the Ki-44 followed a more Western approach, proving fast and stable with good climb and dive properties. This Ki-44-IIb flew from Canton in China with the 85th Sentai during 1944.

JAPAN

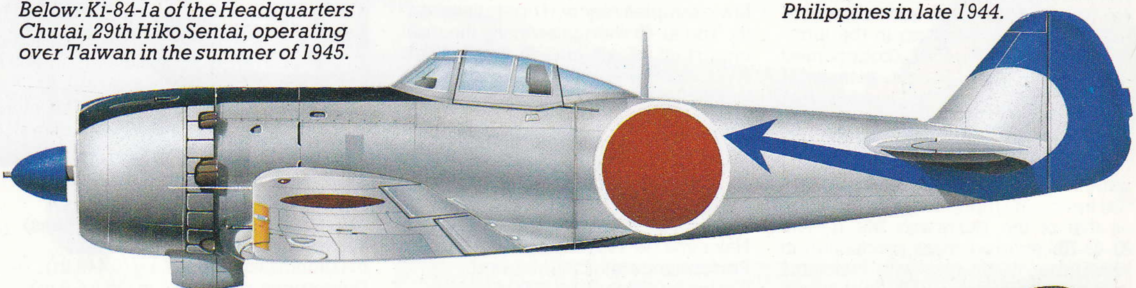
Nakajima Ki-84 Hayate

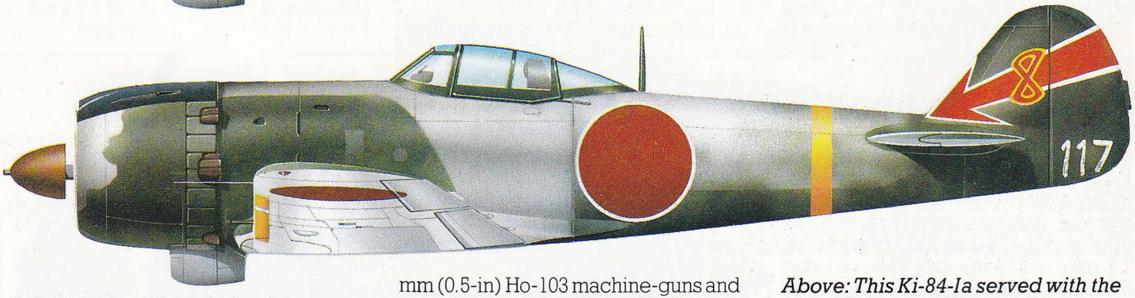
Best of all Japanese fighters available in quantity during the last year of the war, the **Nakajima Ki-84 Hayate** (gale) not only possessed a reasonable performance but (unusual among Japanese aircraft) carried a powerful armament capable of knocking down the heavily armed and armoured American bombers. Not flown in prototype form until April 1943, the Ki-84 met with immediate approval by Japanese army air force pilots, but was subjected to lengthy service trials which undoubtedly delayed its introduction to combat operations. Production got under way at Nakajima's Ota plant in April 1944, pre-production aircraft having equipped the 22nd Sentai in China the previous month. Immediately afterwards 10 *sentais* of the **Ki-84-I**, codenamed **'Frank'** by the Allies, were deployed in the Philippines to confront the advancing American forces. In an effort to accelerate production of the excellent new fighter, Nakajima opened up a new line at its Otsonomiya plant, and as Boeing B-29 raids began to take their toll of Japanese cities a new 'bomber destroyer', the **Ki-84-Ic**, was produced with an armament of two nose-mounted 20-mm cannon and two wing-mounted 30-mm cannon. Some measure of the importance attached to the Ki-84 may be judged by the fact that in the last 17 months of war 3,382 aircraft were completed, this despite the tremendous havoc wrought by the B-29 raids and the fact that, owing to such damage at Musashi, Nakajima's engine plant had to be transferred elsewhere.



Above: One of the early Hayates, this Ki-84-Ia saw service with the 1st Chutai, 73rd Hiko-Sentai over the Philippines in late 1944.

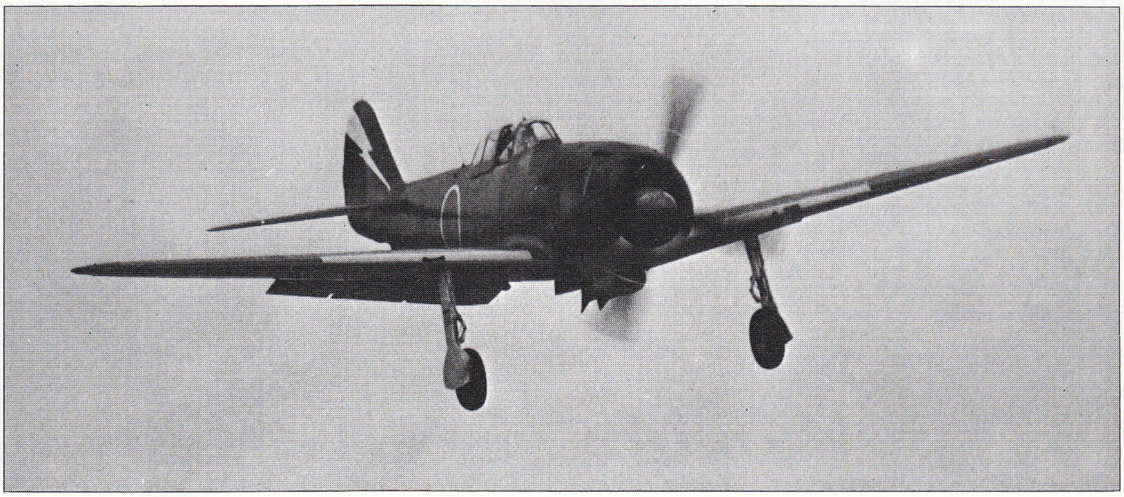
Below: Ki-84-Ia of the Headquarters Chutai, 29th Hiko Sentai, operating over Taiwan in the summer of 1945.





Above: This Ki-84-Ia served with the 183rd Shimbutai (Special Attack Group) from Tatebayashi, Japan, during the last few days of the war.

Specification
Nakajima Ki-84-Ia
Type: single-seat fighter and fighter-bomber
Powerplant: one 1342-kW (1,800-hp) Nakajima Ha-45 radial piston engine
Performance: maximum speed 631 km/h (392 mph) at 6120 m (20,079 ft); climb to 5000 m (16,404 ft) in 5.9 minutes; service ceiling 10500 m (34,449 ft); range 1695 km (1,053 miles)
Weights: empty 2660 kg (5,864 lb); maximum take-off 3890 kg (8,576 lb)
Dimensions: span 11.24 m (36 ft 10.5 in); length 9.92 m (32 ft 6.6 in); height 3.39 m (11 ft 1.5 in); wing area 21.00 m^2 (226.05 sq ft)
Armament: two nose-mounted 12.7-mm (0.5-in) Ho-103 machine-guns and two wing-mounted 20-mm Ho-5 cannon, plus two 250-kg (551-lb) bombs under the wings



The Ki-84 was a fine fighter which proved a handful for American pilots. Fortunately for them, the aircraft was not available in large numbers and these were overworked, resulting in maintenance and reliability problems.

Soviet Navy

Part 4

SOVIET NAVY ORDER OF BATTLE

Manpower: 500,000 (including 16,000 Naval Infantry, 14,000 coastal artillery and rocket troops, and 68,000 naval aviation personnel) plus 840,000 reservists

One of the eight Modified 'Kotlin' class destroyers is shown with a twin SA-N-1 Goa SAM launcher aft.

Northern Fleet

1. Warships

SSBNs: three 'Typhoon'*, 17 'Delta I' and 'Delta III'*, four 'Delta II', 14 'Yankee I', one 'Yankee II', one 'Hotel II', and one 'Hotel III'
SSBs: one 'Golf II', one 'Golf III' (trials), and one 'Golf V' (trials)
SSGNs: three 'Oscar'*, one 'Papa', six 'Charlie II', six 'Charlie I', and about 15 'Echo II' and 'Echo II (Mod)'
SSNs: one 'Mike'*, two 'Sierra'*, six 'Alpha', six 'Victor II', and 40 'November', 'Victor I', 'Victor III' and 'Yankee' SSN conversions (including some for trials)
SSGs: eight 'Juliett'
SSs: 10 'Romeo', four 'Zulu', one 'India', one 'Bravo', and 36 'Tango', 'Foxtrot' and 'Whiskey'
carrier: one 'Kiev'
missile cruisers: two 'Kirov'*[a], one 'Slava', six 'Kresta II', and two 'Kresta I'
light cruisers: two 'Sverdlov'
missile destroyers: three 'Sovremenny'*, four 'Udaloy'*, two 'SAM Kotlin', two 'Kashin' and 'Kashin (Mod)', and five 'Kanin'
destroyers: four 'Kotlin', 'Kotlin (Mod)', 'Skory' and 'Skory (Mod)'
missile frigates: nine 'Krivak I' and 'Krivak II'
frigates: 45 'Riga', 'Grisha I', 'Grisha III'*, 'Petya I', 'Petya I (Mod)' and 'Petya II'
corvette/missile craft: 30
light forces: 30
MCM vessels: 65
amphibious warfare vessels: eight LSTs, six LSMs, and four hovercraft
major auxiliaries: 85

2. Aviation: 320 combat aircraft and helicopters, plus 95 transports and training aircraft

bombers: 100 aircraft in one Tu-26 'Backfire-B' regiment, and three Tu-16 'Badger-C' and 'Badger-G' regiments
fighters: 12 aircraft in one Yak-36 'Forger-A' squadron
fixed- and rotary-wing ASW: 135 aircraft in one Tu-142 'Bear-F' regiment, one Il-38 'May-A' and 'May-B' regiment, one Be-12 'Mail' regiment, one Mi-14 'Haze-A' regiment, two Ka-25 'Hormone-A' regiments, and one Ka-27 'Helix-A' regiment
tanker, reconnaissance and tactical support: 85 aircraft in one Tu-142 'Bear-D' regiment, and one Tu-16 'Badger-D/E/F/K' regiment; 'Badger' strike regiments also have 'Badger-A' inflight-refuelling tankers, 'Badger-H' chaff aircraft and 'Badger-J' ECM aircraft, plus some six to eight Ka-25 'Hormone-B' ECM/guidance helicopters and two or three An-12 'Cub-B' Elint aircraft

3. Naval Infantry

one regiment of Naval Infantry
one brigade of Spetsnaz troops
several independent Spetsnaz companies
unknown number of coastal artillery and rocket troop units

The Kirov. The second ship of the class, differs in having the 100-mm guns replaced by a twin 130-mm (5.1-in) mount and the SS-N-14 launcher by vertical launch SA-N-8 SAM systems.

Baltic Fleet

1. Warships

SSBs: six 'Golf II'
SSGs: four 'Juliett', and one 'Whiskey Twin Cylinder'
SSs: one 'Bravo' and 20 'Foxtrot' and 'Whiskey'
light cruisers: two 'Sverdlov'
missile destroyers: three 'Kashin' and 'Kashin (Mod)', one 'SAM Kotlin', two 'Sovremenny'*, and four 'Udaloy'*
destroyers: four 'Kotlin', 'Kotlin (Mod)', 'Skory' and 'Skory (Mod)'
missile frigates: six 'Krivak I' and 'Krivak II'
frigates: 25 'Riga', 'Grisha I', 'Grisha III'*, 'Mirka I', 'Mirka II', 'Petya I', 'Petya I (Mod)', 'Petya II' and 'Petya II (Mod)' (trials)
corvette/missile craft: 50
light forces: 110
MCM vessels: 130
amphibious warfare vessels: five LSTs, 16 LSMs, and 18 hovercraft
major auxiliaries: 35

2. Aviation

230-250 combat aircraft and helicopters, plus 40 transports and training aircraft
bombers: 100 aircraft in one Tu-26 'Backfire-B' regiment, one Tu-22 'Blinder-A' regiment, and two Tu-16 'Badger C' and 'Badger-G' regiments
fighters: 40 aircraft in one Su-20 'Fitter-C' and 'Fitter-D' regiment
fixed- and rotary-wing ASW: 50-60 aircraft in one Be-12 'Mail' regiment, one Mi-14 'Haze-A' regiment, and one Ka-25 'Hormone-A' regiment, plus 10-12 Mi-14 'Haze-B' MCM helicopters in one independent squadron, and several Ka-27 'Helix-A' helicopters
tanker, reconnaissance and tactical support: 30-40 aircraft in support of the various strike regiments, and comprising 'Badger-A' inflight-refuelling tankers, 'Badger-H' chaff aircraft and 'Badger-J' ECM aircraft for the Tu-16 regiments, and two or three 'Blinder-C' maritime reconnaissance aircraft for the Tu-22 regiment, plus some six to eight Ka-25 'Hormone-B' ECM/guidance helicopters and two or three An-12 'Cub-B' Elint aircraft

3. Naval Infantry

one regiment of Naval Infantry
one brigade of Spetsnaz troops
several independent companies of Spetsnaz troops
six battalions of coastal artillery and rocket troops

12 PASS

Black Sea Fleet

1. Warships

SSG: one 'Whiskey Twin Cylinder' (training)
SSs: one 'Bravo', and 24 'Tango', 'Foxtrot' and 'Whiskey'
carrier: one 'Kiev'
helicopter carriers: two 'Moskva'
missile cruisers: two 'Kynda', four 'Kara', and two 'Slava'*
light cruisers: two 'Sverdlov', and one 'Sverdlov' (command)
missile destroyers: 10 'Kashin' and 'Kashin (Mod)', three 'SAM Kotlin', and three 'Kildin (Mod)'
destroyers: eight 'Kotlin', 'Kotlin (Mod)', 'Skory' and 'Skory (Mod)'
missile frigates: seven 'Krivak I' and 'Krivak II', and one 'Krivak III'*
frigates: one 'Koni', and 44 'Riga', 'Grisha I', 'Grisha III'*, 'Mirka I', 'Mirka II', 'Petya I', 'Petya I (Mod)' and 'Petya II'
corvette/missile craft: 30
light forces: 110
MCM vesels; 100
amphibious warfare vessels: five LSTs, 18 LSMs, and 21 hovercraft
major auxiliaries: 55

2. Aviation: about 290 combat aircraft and helicopters, plus 85 transports and training aircraft
bombers: 100 aircraft in one Tu-26 'Backfire-B' regiment, one Tu-22 'Blinder-A' regiment, and two Tu-16 'Badger-C' and 'Badger-G' regiments
fighters: 12 aircraft in one Yak-36 'Forger-A' squadron
fixed- and rotary-wing ASW: 135 aircraft in one Il-38 'May-A' and 'May-B' regiment, one Be-12 'Mail' regiment, one Mi-14 'Haze-A' regiment, two Ka-25 'Hormone-A' regiments, and one Ka-27 'Helix-A' regiment
tanker, reconnaissance and tactical support: 30-35 aircraft in support of the various strike regiments, and comprising 'Badger-A' inflight-refuelling tankers, 'Badger-H' chaff aircraft and 'Badger-J' ECM aircraft for the Tu-16 regiments, and two or three 'Blinder-C' maritime reconnaissance aircraft for the Tu-22 regiment, plus some six to eight Ka-25 'Hormone-B' ECM/guidance helicopters and two or three An-12 'Cub-B' Elint aircraft

3. Naval Infantry

one regiment of Naval Infantry
one brigade of Spetsnaz troops
several independent Spetsnaz companies
unknown number of coastal artillery and rocket troop units

Pacific Fleet

1. Warships

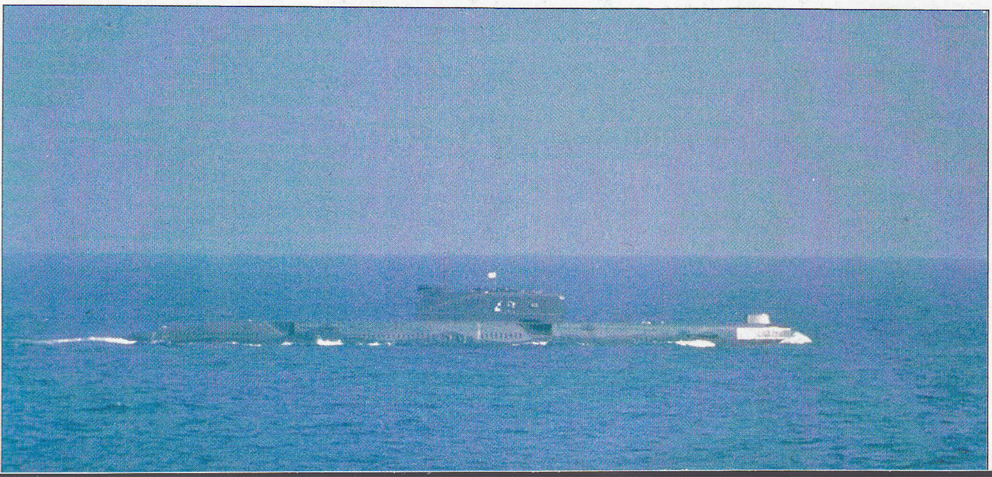
SSBNs: 15 'Delta I' and 'Delta III'*, nine 'Yankee I'. and one 'Hotel II'
SSBs: six 'Golf II'

Now being replaced by the more modern 'Krivak III' and 'Grisha III' frigate classes, the 'Riga' is still useful as an escort for supply and other auxiliary ships. The armament of 100-mm (3.9-in) DP and light AA guns has been superseded in the later classes by integrated missile and close-in weapon systems.

SSGNs: five 'Charlie I' (of which one sank in 1980 and was later salvaged, presumably for recommissioning), and about 14 'Echo II' and 'Echo II (Mod)'
SSGs: four 'Juliett'
SSNs: five 'Echo I', and 17 'November', 'Victor I' and 'Victor III'*
SSs: eight 'Kilo'*, one 'India', one 'Bravo' and 44 'Foxtrot' and 'Whiskey'
carriers: two 'Kiev'
missile cruisers: three 'Kara', three 'Kresta II', two 'Kresta I', and two 'Kynda'
light cruisers: three 'Sverdlov', and one 'Sverdlov' (command)
missile destroyers: three 'Kanin', four 'Kashin' and 'Kashin (Mod)', one 'Kildin', and two 'SAM Kotlin'
destroyers: eight 'Kotlin', 'Kotlin (Mod)', 'Skory' and 'Skory (Mod)'
missile frigates: 10 'Krivak I' and 'Krivak II', and one 'Krivak III'*
frigates: 46 'Riga', 'Grisha I', 'Grisha III'*, 'Petya I', 'Petya I (Mod)' and 'Petya II'
corvette/missile craft: 40
light forces: 150
MCM vessels: 100
amphibious warfare vessels: two LPDs*, 13 LSTs, 10 LSMs, and 22 hovercraft
major auxiliaries: 84

2. Aviation: 340 combat aircraft and helicopters, plus 60 transports and training aircraft

A 'Juliett' class SSG cruise missile submarine is seen, armed with four SS-N-3A 'Shaddock' anti-ship cruise missiles. The 16 'Julietts' operate with the Northern, Baltic and Pacific Fleets; one is normally found at any one time on deployment from the Northern Fleet in the Mediterranean.



bombers: 120 aircraft in one Tu-26 'Backfire-B' regiment, and four Tu-16 'Badger-C' and 'Badger-G' regiments
fighters: 64 aircraft in two Yak-36 'Forger-A' squadrons, and one Su-20 'Fitter-C' and 'Fitter-D' regiment
fixed- and rotary-wing ASW: 150 in one Tu-142 'Bear-F' regiment, one Il-38 'May-A' and 'May-B' squadron, one Be-12 'Mail' regiment, one Mi-14 'Haze-A' regiment, three Ka-25 'Hormone-A' regiments, and one Ka-27 'Helix-A' squadron
tanker, reconnaissance and tactical support: 90 in one Tu-142 'Bear-F' regiment and one Tu-16 'Badger-D/E/F/K' regiment; Tu-16 strike regiments also have 'Badger-A' inflight-refuelling tankers, 'Badger-H' chaff aircraft and 'Badger-J' ECM aircraft, plus some six to eight Ka-25 'Hormone-B' ECM/guidance helicopters and two or three An-12 'Cub-B' Elint aircraft

3. Naval Infantry

one reinforced brigade of Naval Infantry
one brigade of Spetsnaz troops
several independent Spetsnaz companies
unknown number of coastal artillery and rocket troop units

Mediterranean Squadron (5th Eskadra)

This normally comprises six to eight torpedo attack submarines ('Foxtrot' and 'Tango' SS with occasional 'Victor I', 'Victor II' and 'Victor III' SSN) and one or two cruise-missile submarines (one 'Juliett' SSG and/or one 'Echo' or 'Charlie' SSGN) from the Northern Fleet, plus one helicopter carrier, one or two missile cruisers, six to eight escorts (missile destroyers, destroyers, missile frigates and frigates), one to three MCM vessels, one to three amphibious warfare vessels, and 15 to 20 auxiliaries from the Black Sea Fleet.

Indian Ocean and South China Sea Squadron

This normally comprises two or three submarines, eight surface combatants, two amphibious warfare vessels and 12 auxiliaries from the Pacific Fleet, with strike and reconnaissance aviation units forward-deployed to bases in Ethiopia, South Yemen and Vietnam on a semi-permanent basis.

Caspian Sea Flotilla

This is primarily a patrol force of small combatants and auxiliaries, and its numbers are included in the totals for the Black Sea Fleet.

Notes: * indicates a class in series construction
[a] indicates that the second unit, the *Frunze*, is believed to be on the point of transfer to the Pacific Fleet as a surface strike group flagship.